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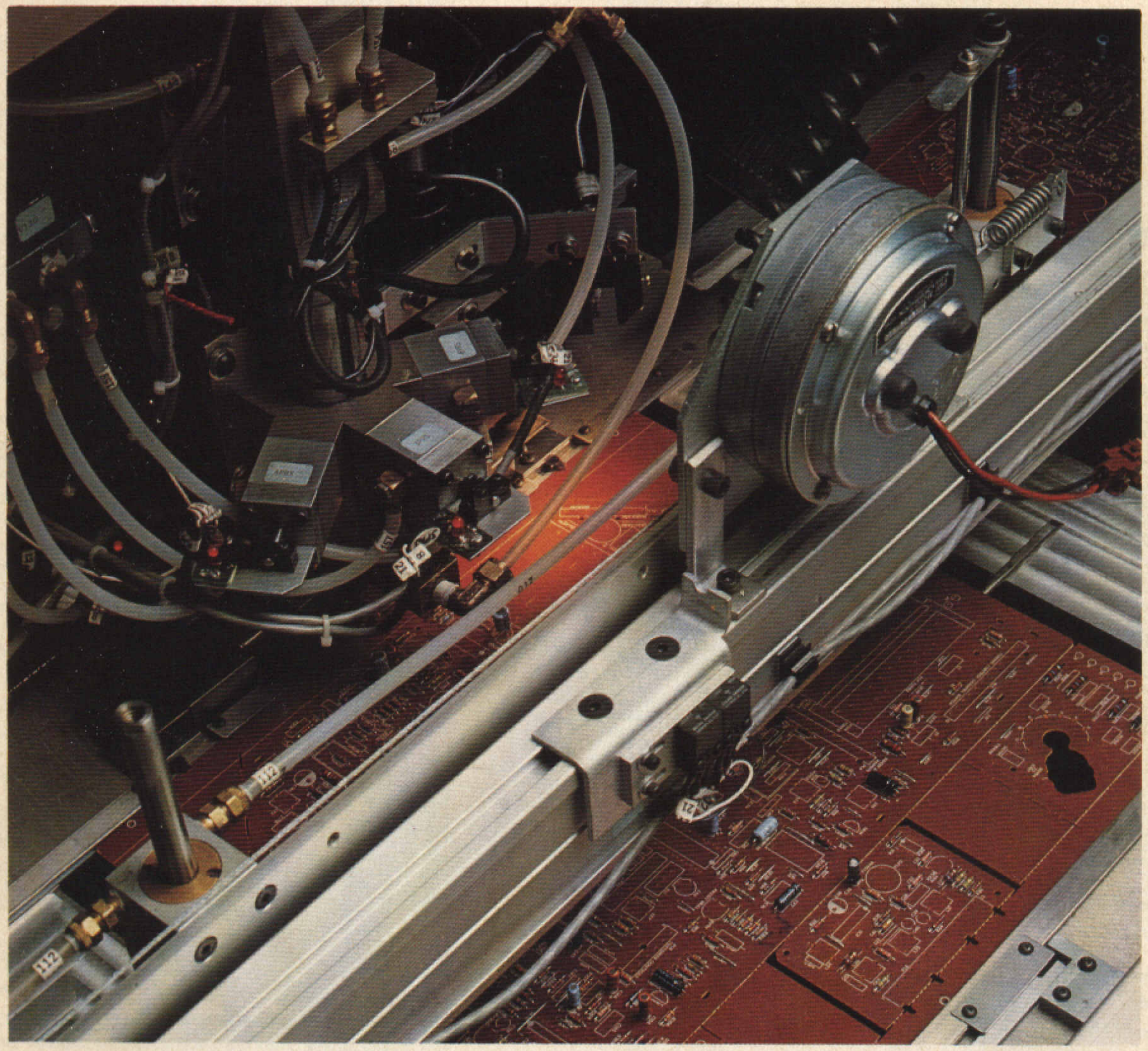

A TV MAN'S GUIDE TO VIDEO

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TELEVISION

January 1982

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Requests for advice in dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

this month

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TELEVISION

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Mixed Results

The year 1981 will surely go down in the annals as one of the strangest in the history of the UK's domestic TV industry. Just over a year ago, Rank decided to end their joint TV setmaking venture with Toshiba, while Philips decided to close down their Lowestoft TV plant – the old Pye factory. A question mark was also hanging over Decca's future, following the take-over of the company by Racal who didn't want to become involved in consumer electronics. The situation looked grim indeed, the only optimistic gesture coming from Fidelity with their surprise decision to enter the TV manufacturing area, first with monochrome portables and then with a 14in. colour transportable.

A year later, the situation is very different. Toshiba are successfully turning out sets at the old Rank plant in Plymouth, Decca Radio and Television have found a new parent company in Tatung and have introduced a smart new range of sets featuring the new 120/130 series chassis, the Murphy brand has resurfaced, with sets using chassis produced in the UK by Rediffusion, while perhaps the greatest surprise is the fact that Sanyo have just bought the Lowestoft TV plant – to produce TV sets and later VCRs. As for Fidelity, it seems that their plunge into TV manufacture came at the right time. According to chairman Jack Dickman, the 14in. colour set is at present the company's main source of profit: a 20in. model is to be introduced shortly, and there are plans to distribute and, within the next couple of years, manufacture VCRs.

It's certainly been a remarkable transformation, and leads one to ask how and why? If anyone wonders why we were going on in this column about the excessive exchange value of the pound in late 1980, the link with everyday production must by now be clear. A year ago, foreign produced goods were cheap and UK produced ones non-competitive. Let's hope the lesson has been learnt. But that brief period of a grossly over-valued pound was only part of the answer. It came unfortunately after several years of generally poor performance in UK industry, with inadequate profitability (in some cases mounting losses) and lack of investment: so many a borderline concern finally closed.

Now that the transformation scene has taken place in the TV industry, we find that a considerable change has occurred in its ownership. When Sanyo's plans come to fruition, all the major Japanese setmakers will be active in the UK – Panasonic, Sony, Toshiba, Mitsubishi and Sanyo with their own plants, Hitachi in conjunction with GEC, while Sharp have an agreement with Rediffusion. And of course Tatung are now successfully operating from Bridgnorth. Just what is it about these oriental manufacturers that enables them to succeed where others have failed? All sorts of answers have been put forward, such as attention to quality control and continuous production without stoppages due to disputes or to production bottlenecks. These things help of course, but there are other factors. Japanese manufacturers for example have the benefit of government backed loans at low rates of interest. We all know about the massive investments made by Japanese manufacturers compared to others: it helps when you operate profitably and have ready access to funds under favourable conditions! The point about all this would seem to be that profitable TV assembly plants can be run in the UK when the research and development and other overhead costs are taken care of under different circumstances elsewhere. There's nothing nefarious about this: where inflation is low, interest rates will be low. It's just one aspect of the insidious effect inflation has on our economy.

On the retail side, the picture has been much more rosy. Demand for new TV sets has kept up, while the demand for VCRs has soared (up by 322% in the second quarter of the year compared to the same period in the previous year – figures for later quarters have been delayed by last year's civil service strike). For how long this will last is another matter. There's a lot of evidence to suggest that redundancy payments have helped to sustain the TV/VCR market over the last year. Hopefully, this will be a factor of decreasing significance. Unfortunately the continued recession and increases in living costs mean that earnings are being squeezed. The outlook for the next few months is of a difficult though still buoyant retail scene, since large numbers of old, hybrid colour sets are still being replaced and the video boom shows no sign of slackening off.

Since the demand for VCRs is so great and the Japanese don't seem to be able to make enough of them, why don't we make the things ourselves? There are signs that we will be doing so before long. But the answer to this one has already been touched on in connection with TV sets. What we'll be doing is assembling machines designed and developed elsewhere. The costs of developing a machine along with the production technology required to make it into a competitive, reliable mass-produced item are huge. Very few companies have the financial resources for this sort of thing.

Farther ahead there lies satellite TV. Mackintosh Consultants in a report entitled "Satellite Broadcasting" suggest that sales of receiving equipment in North America and Western Europe will approach $2 billion annually by 1990, whilst the cumulative investment in the satellites is likely by then to have reached $1·5 billion. As far as the receivers go, I think we can already guess who will have made the necessary R and D investment.

PRICE INCREASE

The price of *Television* will be 80p from our next, February issue. We regret the need for this increase, but the costs of all those involved in bringing you the magazine – retailers, wholesalers, printers and publishers alike – continue to rise.

HELD OVER

Due to production difficulties with this issue, Part 2 of the microcomputer clock-timer project has had to be held over till next month.

COVER PHOTO

Our cover photograph this month shows automatic component insertion equipment in use on the Thorn TX9 chassis assembly line. 75% of the components in the TX9 chassis are automatically inserted – in the TX10 chassis the figure is 70%. The equipment inserts interconnecting wire links, axial and radial components and panel link pins. Our thanks to Thorn Consumer Electronics Ltd. who provided the photograph.

Teletopics

SANYO TO MANUFACTURE IN UK

Negotiations between Sanyo and Philips for the purchase by Sanyo of the Philips/Pye Lowestoft TV factory have now been successfully completed. Philips announced the closure of the plant a year ago, with the aim of concentrating production at Croydon. The plant has not been completely run down however, and Sanyo will acquire manufacturing facilities in addition to most of the 25-acre site. The aim is to start with a colour TV production line and to follow up with VCR production if the venture achieves target levels.

VCR BOOM CONTINUES

Every VCR sales/rental figure one sees is higher than the last – the latest estimate for 1981 is for 800,000 UK sales/rentals. It's interesting to compare the VCR take off with CTV sales and rentals a decade ago. Approximate figures are as follows:

Year	*CTV disposals*	*Year*	*VCR disposals*
1968	50,000	1978	75,000
1969	140,000	1979	180,000
1970	600,000	1980	400,000
1971	800,000	1981	800,000

A remarkable similarity – and 1972-3-4 were the boom years for colour TV. We won't get a Barber boom this time, but the video market should continue to grow. This naturally leads to indications that the time may be right to start VCR production in the UK – the market is there, and Japanese consumer electronics manufacturers have a tradition of setting up satellite plants in foreign markets. Grundig have been seeking a partner in the UK to produce V2000 standard machines, and Fidelity Radio are planning to produce VHS machines. Tatung will shortly be introducing a JVC manufactured machine, the Deccavideo VRH8300, and are understood to be evaluating the V2000 system. Production of VCRs in Japan last September for the first time exceeded CTV production.

NEW PROJECTION TV SYSTEM

Super-Screen Video, 17a Old Road, Leighton Buzzard, Beds, have introduced a single-tube projection TV system based on the Thorn TX9 chassis. The basic set used is the 14in. remote controlled model, with a three-element optical glass lens added to project the output from the tube on to a 60 or 72in screen. There are free-standing and ceiling-mounted versions, the sound being fed to twin speakers via a 35W amplifier. Prices range from £1,150-£1,550 plus VAT.

PYE APPRENTICE OF THE YEAR

The 1981 Pye Apprentice of the Year is Paul Wigmore, a video engineer with Radio Rentals. Paul joined the company in 1977 and is currently an Advanced Technician (Video) at a Brighton branch. Runners up were Kevin Darnell of R. S. Hill Ltd. and Robert Barnell of J. R. Ward Computers Ltd. The aim of the award is to encourage high standards of education and training amongst those engaged in TV servicing – the scheme has been in operation for ten years. Whilst the demand for servicing staff has dropped during the period, the more sophisticated sets of today, coupled with video equipment, call for higher standards than ever.

TRANSMITTER OPENINGS

The following relay transmitters are now in operation:
Bishop's Stortford TV4 (future) ch. 49, BBC-1 ch. 55, Thames/London Weekend Television ch. 59, BBC-2 ch. 62.
Dollar TV4 (future) ch. 54, BBC-1 ch. 58, Scottish Television ch. 61, BBC-2 ch. 64.
Llanrhaeadr-ym-Mochnant BBC-Wales ch. 39, Sianel 4 Cymru (future) ch. 42, BBC-2 ch. 45, HTV Wales ch. 49.
Trefin BBC-Wales ch. 22, HTV Wales ch. 25, BBC-2 ch. 28, Sianel 4 Cymru (future) ch. 32.

The above transmissions are all vertically polarised.

VIDEO DISC LATEST

There's still no indication of the UK launch date for the Philips LaserVision disc system. It seems that disc output at the Blackburn plant has yet to reach satisfactory levels. Meanwhile Philips have been carrying out an extensive training programme for engineers from potential distributors. To simplify player servicing, Philips have used the modular approach employed in their current VCRs and TV chassis. Philips have also announced the development of a solid-state laser suitable for video disc use – the aluminium-gallium-arsenide device is said to be easy to produce and capable of stable, low-noise operation.

There are indications that the RCA SelectaVision disc system has not been selling as well as expected since its launch in the USA last March: there have been layoffs at the Bloomington, Indiana factory, and dealers have been making special offers to encourage sales. RCA seem to be prepared to wait for the disc to catch on however – after all it took some ten years for colour TV, which RCA pioneered in the States, to become a success there. One cause of consumer resistance to disc systems seems to be the fact that there are at present far more titles available in videocassette form than on disc.

For those interested in the technicalities of the RCA disc system, Fig. 1 shows the basic replay technique. The video and audio information are stored in the disc in the form of capacitance variations along the track, the varying stylus-disc capacitance as the disc rotates forming part of a resonant circuit whose centre frequency is 910MHz. Also coupled to the circuit is the output from a stable 915MHz oscillator. The result of mixing these two signals is an amplitude-modulated output which is peak detected to produce an f.m. signal corresponding to the signal recorded on the disc. This signal is then fed to separate video and audio f.m. demodulators. In the NTSC version, a 1·53MHz

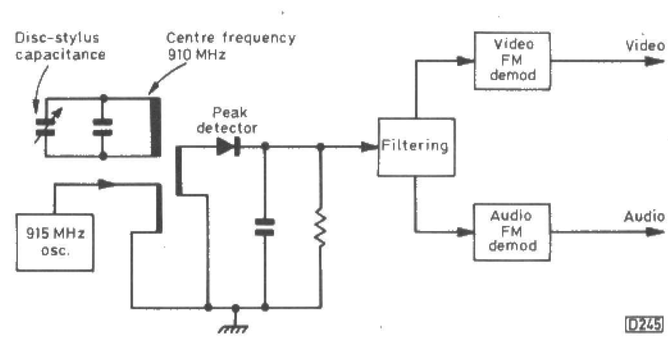


Fig. 1: Principle of the SelectaVision disc replay system.

subcarrier is used for the chroma signal, the luminance and chrominance components of the signal being separated by means of a comb filter. The video bandwidth is 3MHz.

THORN EXTEND TUBE GUARANTEE

Thorn have extended to two years the basic guarantee period for their Newlife range of regunned replacement tubes, with an option to extend the warranty to four years. The range now includes replacements for the more popular types of in-line gun tubes.

LOPT TESTER

J. Baker and Co., 1 Old Shoreham Road, Southwick, Sussex have introduced at £16.50 inclusive (c.w.o.) a new tester for checking line output transformers for shorted turns. Since the usual technique is to test transformers by substitution, the new instrument could save much time and effort. We hope to publish a review of the instrument in a later issue.

TELETEXT SUCCESS

Thorn report that teletext has been a growing success in the rental sector of the TV market since the government's decision to relax rental down payments. Deliveries of TCE's TX teletext sets were "exceptional" in July, were sustained through August and increased in September (at the lead up to National Teletext month). Prior to October, rental companies that responded to the changed statutary controls saw teletext sets take over 20% of new rental business. Deliveries of teletext sets are expected to have reached 150,000 in 1981, the industry target for 1982 being 500,000.

Mullard have announced the production of their four millionth teletext chip: output from their Southampton plant has risen from 6,000 in 1978 when production began to the present figure of over four million a year. An investment of millions of pounds and many years of intensive design and development work has been made by Mullard in teletext chip technology. There have been several redesigns over the years, leading to the present four-chip decoder set.

MAVICA LAUNCH

Sony plan to launch their video still-picture camera in the US market from mid-1983, at a price of around $1,000. An article on the camera appears overpage.

NEWS FROM NEWARK

The next of Steve Beeching's VCR Training Courses will be held on January 30-31st – for details of this two-day weekend course apply to the Newark Video Centre, 108 London Road, Balderton, Newark, Notts. Steve tells us that he can now supply receiver/monitor versions of the latest Grundig TV range – Models 3105, 6100, 7100 and 8400. Another interesting item (see Fig. 2) is a camera switcher unit for use with the JVC GX33 and GX88 video cameras – the unit has been designed to provide switching with minimal picture break up and servo disturbance when replaying via a VCR. Each camera is powered by the switcher unit, the audio and video outputs required being selected by solid-state switching, logic controlled, when the appropriate illuminated push-button is operated. The sync detector circuit illuminates an l.e.d. indicator when the field sync pulses from the two cameras are within 3msec of each other: if the indicator does not light, the user switches the

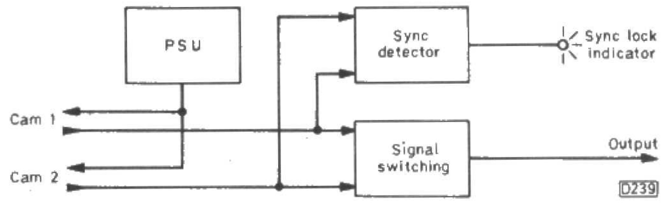


Fig. 2: The Newark Video camera switcher.

power on and off until synchronous running of the two cameras is achieved. It's recommended that VCRs with a rapid servo response, such as the JVC HR7700 and HR2200, are used with the unit. The switcher is produced to order only, at a price of £210 plus VAT.

BBC SATELLITE TERMINAL

A mobile satellite link terminal has been completed by the BBC Engineering Research Department and put into use for television outside broadcasts. The complete transmitter is housed on a relatively light-weight trailer which can be coupled to any standard radio link van. The terminal includes a 3m dish aerial, two 600W 14GHz transmitters, check receivers, f.m. modem and other associated equipment. Work on the project commenced only some 18 months ago, completion having been achieved in good time to meet scheduled programme requirements.

FLASHOVER PROTECTION

Many and varied have been the techniques used to provide c.r.t. flashover protection in colour receivers, starting with careful earthing arrangements and spark gaps linked to vulnerable electrodes and culminating, so we thought, in the soft-flash system. Yet another technique has been adopted in the latest RCA tubes, in which thin conductive areas are placed on the glass rods that support the gun assembly. Tubes using this arrangement are being fitted in the latest range of RCA colour receivers.

MORE VCRs

New VCRs seem to be appearing at an ever increasing rate. Five new machines have been announced this month, as follows:

JVC HR7300EK. Described as a medium priced recorder with a comprehensive time-shift capability. There's a 14-day/8-programme timer and a Dolby noise reduction system for improved sound quality.

Panasonic NV7200. A successor to the NV7000, with infra-red remote control.

Hitachi VT8700 and VT6500. Successors to the VT8500 and VT7000 respectively. The VT8700 is a top-of-the-range machine and the VT6500 a portable.

Saba VR6010. Features include a 10-day/8-channel timer and optional wired remote control.

PUBLICATIONS

The latest volume in the IBA Technical Review series is entitled "Microelectronics in Broadcast Engineering". The 52-page book has seven sections describing the use of microelectronics in a wide range of broadcast applications: TV subjects include the IBA electronic test pattern generator and enhanced graphics for teletext. Enquiries to the IBA Engineering Information Service, Crawley Court, Winchester, Hants.

Link House have published the "Home Video Yearbook – 1982", which is intended to complement their "Video

Yearbook". It's aimed at the growing home video market, dealing with both the software and hardware available and including an index section that provides addresses.

MTV EXPAND

Midland TV Trade Services have moved to a new automated and computerised warehouse complex at Franchise St., Kidderminster, where they now have the largest stockpile of used colour sets in the UK. To cope with an increasing flow of orders, particularly from overseas, the staff has been doubled. The present team of 24 full-time engineers is to be further increased to 40 within the next six months. Another new venture by MTV is marketing and distributing manufacturers' seconds, end-of-line runs and catalogue returns.

MAVICA

David K. Matthewson, B.Sc., Ph.D.

Mavica camera with lenses and Mavipaks.

A RECENT *Teletopics* item referred to Sony's development of a video still picture camera system – Mavica (*ma*gnetic *vi*deo *ca*mera). The idea is to integrate photography with domestic TV. The Mavica system is aimed squarely at the top end of the amateur photography market, the camera itself recording high-quality colour pictures on a small magnetic disc called a Mavipak instead of on a silver- or a dye-based film.

It's fair to say that this is the first major development in still photography since the advent of Polaroid film. Since the image is stored in the form of electromagnetic information, it cannot be viewed directly but has to be displayed on a TV screen using a Mavipak viewer. Mavica has been shown only in prototype form so far, in Tokyo, and no firm launch date has been suggested. It's a World "first" however, and as other manufacturers are understood to be working along similar lines it's worth summarizing the details so far released.

Fig. 1 shows the basic layout within the camera, the accompanying photograph showing the camera along with its interchangeable lenses and four Mavipaks. The camera is not exactly pocket size, being 130 × 89 × 53mm and weighing around 800g. It resembles an SLR camera based around a 126 film pack rather than the more familiar 35mm cartridge. Apart from its physical appearance however the Mavica has little in common with a conventional camera.

The light entering via the lens is split two ways by means of a light-splitting mirror, being deflected to an optical reflex viewfinder and passing directly to a CCD image sensor. The CCD sensor converts the optical image into a charge pattern and then, by shift-register action, into a sequential video signal – it's the same sort of device as used in the Sony Cam-Corder (also still under development) and other solid-state cameras. The circuitry on the two PCBs controls the camera action and processes the video signal to produce the magnetic pulses recorded on the disc. The Mavipak disc is small and light – 60 × 54 × 3mm and weighing just 8g.

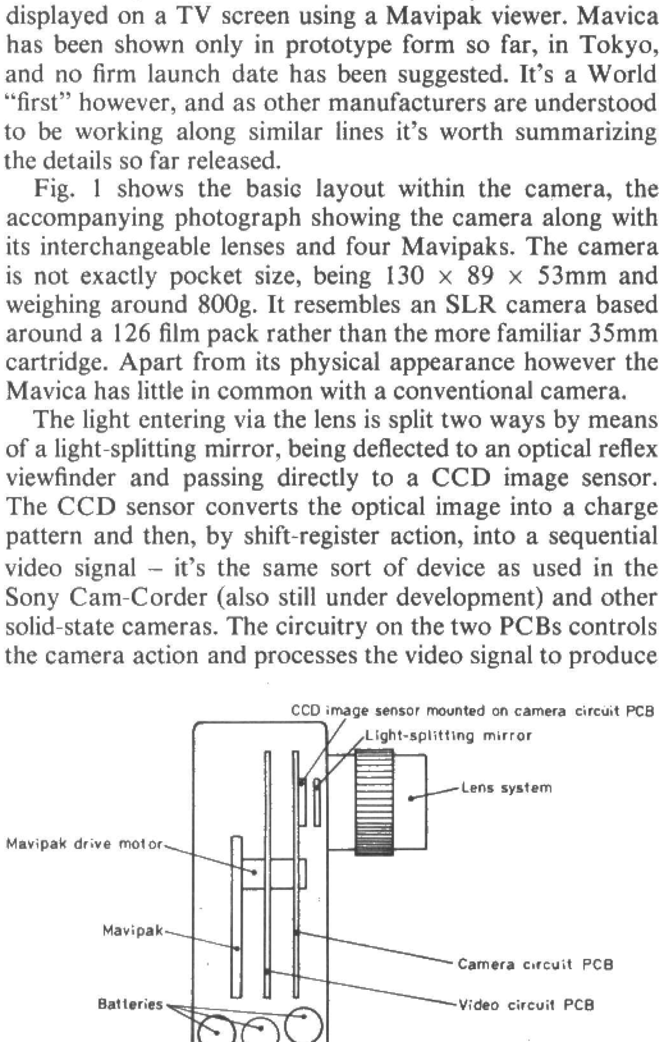


Fig. 1: Layout of Sony's Mavica video stills camera.

Up to 50 stills can be recorded on the Mavipak, the motor drive giving an exposure rate of up to ten pictures a second – in fact Mavica can be used as a normal video camera to produce moving pictures which can be recorded on a VCR. Since the disc is not sensitive to light, it can be removed at any point. If a partially used disc is loaded into a camera the disc is automatically run through to the first free frame to avoid over-recording. The disc can also be erased in its entirety and reused.

To view the pictures the disc is inserted in a Mavica viewer whose output is fed directly to the aerial socket of a standard TV set. The prototype viewer provides a composite video signal and also separate RGB signals – to the NTSC colour standard. If printed copies of the pictures are required, these can be obtained using a printer unit which is at present under development. The Mavipaks can also be duplicated on a copier, and there will also be a Mavipak transmitter to enable the pictures to be sent to remote locations via a telephone line.

The picture quality is not at present as good as a 35mm slide, being more comparable to a 110 photograph, but it's impressive nonetheless. Sony claim that the resolution is 350 lines, with a signal-to-noise ratio of 45dB – this compares favourably with the best current domestic VCRs. Unlike current VCR systems, both the luminance and the colour-difference signals are frequency modulated prior to being recorded. The CCD itself is quoted as having a light-sensitive array consisting of 570 × 490 picture elements. The Mavipak disc's rotational speed is 36 r.p.m., the effective camera shutter speed being settable between 1/60th and 1/1,000th of a second, while the effective film speed is 200 ASA. A self-timer is incorporated.

Further development is expected to take between eighteen months and two years, during which time Sony may well license the technology to other manufacturers in the video and photographic fields. It's certainly an interesting marriage of video and photographic techniques. ■

A TV Man's Guide to Video

Part 1

Harold Peters

OTHER contributors, including Steve Beeching, Derek Snelling and Mike Phelan, have in recent times given guidance to the rest of us on delving inside VCRs to carry out repairs. There must however be many TV engineers who have been far too busy with infra-red control systems, switch-mode power supplies and what have you to have paid much attention to video till now. So what happens when they are faced with say having to install a VCR for the first time?

They may find themselves in front of a customer and unable for the life of them even to see where the thing's turned on. Or say they've been called to a faulty TV set and are asked about some VCR trouble. Being an ever resourceful breed, an engineer in the latter situation would get the user to demonstrate the complaint (this is known to the writer as the Wilkinson Ploy), vowing to look up how to operate the machine later on. Reading VCR operating instructions for the first time can take up to 90 minutes per model however. The purpose of the present article is to help you improve on this considerably – and because the information is very basic and starts at the beginning, I suggest you skip the bits you already know to get to the part you need.

Two misconceptions must be laid at the outset. First, you never turn the VCR off: use it like the lounge clock, kept going 24 hours a day. Secondly the aerial no longer goes to the TV set directly but is looped through the recorder instead. See Fig. 1.

Three programmes go into the machine (four when TV4 gets going), and four/five come out. This means that the signal from the aerial is split, so that the TV set and the VCR can use any of the available signals independently and simultaneously. Splitting always involves losses, so an amplifier in the VCR raises the incoming signals to the initial level, adding the fourth (from the VCR) signal at the same time.

This process can easily make the signal noisy, especially if it starts out at some 800μV – the usual level at which a 30dB signal-to-noise ratio is first attainable. The splitting divides the signal three ways: one third to the TV set, one third to the recorder and one third absorbed in the divider network. In theory the 800μV level should be raised to 2·4mV to compensate, but in practice just over a millivolt is adequate.

The VCR's aerial input socket is of the same type as the TV set's, and so is the lead that connects the recorder and the receiver. Some machines have the convention reversed, i.e. a male end on the recorder chassis and a female end on the coaxial lead. If the special lead normally supplied is broken or missing, a line connector will reverse the sense and permit the use of a conventional coaxial jumper lead.

The TV set itself should be capable of accepting the signal provided by the machine on playback – all sets produced over the last few years have their last tuning button arranged to work with a switch that shortens the time-constant of the flywheel sync circuit. This makes the line lock faster acting, to take care of variations such as tape flutter without producing watery verticals. The standard channel for video use is ch. 36, but all VCRs can be offset by plus or minus 20MHz to avoid co-channel, adjacent channel or image channel (N + 10) interference from the local off-air signals. Retuning is done by means of a grubscrewdriver through a hole without any need for dismantling.

The Three Systems

Before getting too involved in the installation drill, a few words on the three systems now available – VHS, Beta and V2000. There's no compatibility at all between these three, but tapes made on any recorder should replay well on any other machine using the same system. We'll ignore the Philips N1500/N1700 systems which have now been superseded by the 2000 system. The cassettes used are all larger versions of the well-known audio compact cassette, using half inch wide (approximately) tape and feeding from the left-hand spool to the right-hand one. A flap covers the tape when the cassette is withdrawn from the machine, so that it can't be handled. The heads scan the full tape width in the VHS and Beta systems: in the 2000 system the heads scan across half the tape width, so that the cassette can be turned over to get twice the playing time.

The three systems use the same recording principles: the picture is recorded on the tape diagonally, the rotating heads scanning the tape helically, with one field per helical scan and with the sound recorded conventionally on one edge of the tape, a second lateral track being used for the control pulses that synchronise the machine's tracking. The tape speeds are: 18·73mm/sec Beta; 23·4mm/sec VHS; 24·4mm/sec 2000. By comparison, an audio tape is operated at about twice the speed (approximately 47mm/sec). Perhaps surprisingly, the impairment of the sound is less than that of the picture when you hear it played back through a TV set. The typical audio response is flat to 8kHz on all systems, with many machines using Dolby to keep the noise level down.

The video response is often expressed in terms of lines of vertical resolution: a figure of 300 lines, corresponding to a bandwidth of roughly 3MHz, is the best that any system can attain.

The maximum standard playing time is four hours for VHS, slightly less for Beta and eight hours for the 2000 system (four hours then turn the cassette over).

These figures don't tell you too much about practical performance. All three systems are able to give sound and

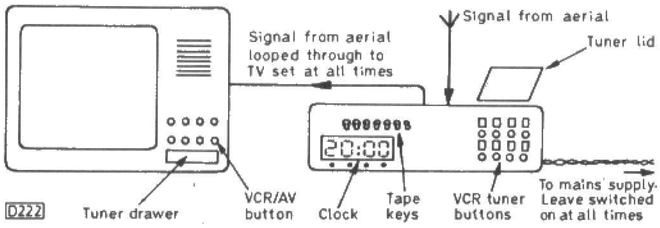
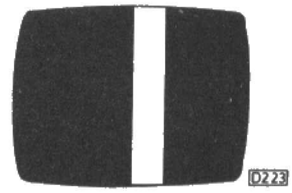


Fig. 1 (left): Elements of a simple video installation.

Fig. 2 (right): Pulse-and-bar type test signal.



pictures of good entertainment value: an engineer with some years' experience would be critical if he watched the results on a 26in. receiver, but the average viewer watching a 20 or 22in. set would be hard put to know whether the signal was off-tape or off-air. There's greater variation between models and brands than between the systems themselves, and it's too early to be able to say which systems or models withstand the ravages of time and use best.

Initial Setting Up

On then to the initial setting up. Recorders fall into two types: basic models which are fairly straightforward to install and use, and sophisticated models with microprocessor control – these are fairly unstraightforward. Cowards ever, we'll deal with basic models first.

The drill is in four parts: connecting up (simple – we've already dealt with this); tuning the TV set to the VCR; tuning the recorder to the local TV stations; and finally setting/checking the clock/timer. If you are going to come unstuck at all, it will be with the two tuning processes. As the snags are common to all models, we'll go through the drill very slowly.

First of all tune the TV set's VCR or AV button to receive the recorder's output. It's a help to be able to play back a known good recording. All recorders produce a pulse-and-bar type test signal which can be brought in by means of a switch however, or by pressing eject to raise the lid (you tune for a sharply defined bar – see Fig. 2). The TV set's a.f.c. must be disconnected whilst tuning in ch. 36 – this is usually automatic when the tuner drawer is opened, though many Japanese sets have a switch that must be moved over.

Now comes the hard bit. The VCR's output is double-

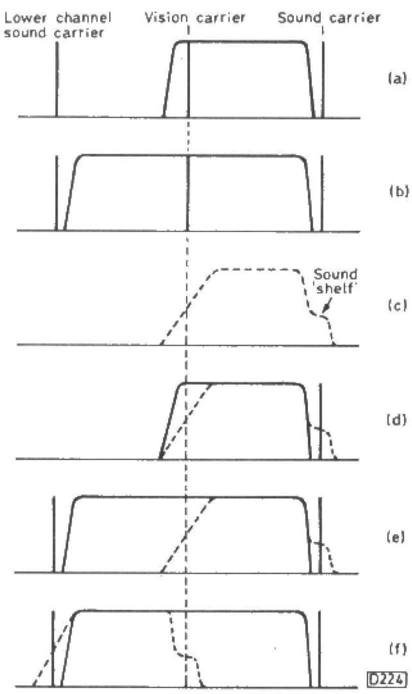


Fig. 3: Tuning. The secret of success is to get the TV set's VCR/AV button tuned to the correct sideband of the recorder's output. (a) Vestigial-sideband broadcast transmission. (b) Double-sideband VCR output on ch. 36. (c) Receiver's i.f. response (mirrored). (d) Broadcast transmission tuned in by the receiver – there is only one tuning possibility. (e) VCR signal correctly tuned in by the receiver – no perceptible difference to (d). (f) VCR signal tuned in by the receiver to the wrong sideband – ringing and patterning will be seen and the a.f.c. action will reverse.

sideband in the playback mode (see Fig. 3). This means that there are two tuning possibilities, only the higher frequency one being right. If you get it wrong the a.f.c., when reconnected, will detune the set rather than pull the tuning in. The prerecorded tape is useful here since although there will be two tuning points where good colour is obtained only one of them will be clean and free from ringing. At this point go back to the broadcast channels and check that they are free from patterning. If not, the VCR's output must be retuned until the patterning is removed from all the other channels. Be careful not to move the patterning on to BBC-2 whilst it's off air, as this will involve another service call.

If all is now well it's time to tune the VCR to your local stations, using the TV set, still switched to VCR/AV, as a monitor. First reconnect the set's a.f.c. by closing the drawer or whatever. Then disconnect the recorder's a.f.c. by opening its drawer. Next put the VCR into its monitor (E-E) mode – different models employ different methods. A typical method is to press record without at the same time pressing play. If the tuning bar is still showing, turn it off. The TV set should now be displaying snow, as though it's off tune.

Select button one of the VCR's tuner and tune in say BBC-1 for a good colour picture with sound. Go to button two, three and four and tune in BBC-2, ITV and any other channel you might want. Close the tuner drawer to bring the VCR's a.f.c. back into action, check back on the recorder buttons you've just tuned in, then check the station buttons on the TV set to make sure that no patterns etc. have crept in.

Then select the TV set's VCR/AV button again. This is the acid test. You should still have good reproduction of the picture you last selected on the recorder – if not you were tuned to the wrong sideband first time. Happily this time you've got a vestigial sideband signal coming out of the VCR, because in the monitor mode it is still the vestigial sideband broadcast signal. You can now use this to fine tune the TV set's VCR/AV channel instead of using the tuning bar: this time there will be only one tuning point, the right one. Remember to do this with the TV set's a.f.c. off (drawer open etc.) and the VCR's a.f.c. on (drawer closed).

Setting the Clock and Timer

On a basic model, setting the time is no more difficult than with a digital wrist watch. Each of the push-buttons usually has a triple function: set clock time; set recording time start; set end of recording time (or length of recording). Seconds are seldom displayed, and time is always shown following the 24 hour convention. Clocks show either the day of the week or count the days from when you set the timer, the day at that time being day zero. Clocks are synchronised to the mains supply, and can be accurately set by holding the set button until the minute changes in real time ("at the third stroke") then letting go. When setting the timer for something like the Midnight Movie, remember that you go through a date change, so you should set the timer to start at Saturday (day zero) 22·50 and end on Sunday (day one) at 0045.

A power cut will cause the clock to flash, read rubbish or show EEEEE (for error). This means that you'll not only need to reset the clock but also any recording programme you've put into the timer.

When the timer has completed the recording programme you've given it, the machine will either stop, rewind, eject or repeat the programme next day, depending on the VCR. As an installation engineer you would normally demonstrate

the machine's ability to select a minute's worth of material as part of your setting-up drill.

Brief Recap

Finally this month a brief recap on the main installation points we've covered so far. (1) The TV aerial is routed through the VCR to the receiver. (2) The recorder is left on at all times. (3) First tune the TV set to the recorder, then use it as a monitor to tune the recorder to the local transmissions. Don't forget that the recorder's off-tape output is double sideband, but a monitored broadcast is not. Don't attempt to tune in with both a.f.c. systems in operation: the set and the VCR will then "play tennis", one trying to correct the other's error.

Having covered the installation drill for basic VCRs we can go on to the more complex machines, look at the knobs on the front and the plugs round the back, and discuss accessories like cameras and remote control. Before this, some observations. As a dealer or engineer you'll lead a happier life if you:

(1) Rent out both the VCR and the TV set (combinations sometimes give trouble).

(2) Select brands known for good back-up service (Japan is a long way to send for a belt).

(3) Persuade people with TV games to play them using a second set (the VCR's aerial pluggery usually defeats them).

(4) Have nothing to do with machines brought in from other countries that use different TV systems. We hear tell of a man who spent ages getting a Secam recorder to pick up PAL. Unfortunately the machine turned it all back to Secam again on playback.

High-definition Television

Andrew Flockton

THE highest definition TV system to have been used for a public broadcasting service is the French 819-line monochrome system, which is now obsolete and in the process of being phased out. The picture definition achieved by any system in which a raster is built up by scanning depends on the number of lines used – the greater the number of lines, the better the picture. There are limits to what can be achieved in practice however. There's no point for example in having a theoretical definition that's greater than the average spot size produced by a c.r.t. beam. And from a transmission point of view, bandwidth is all important. Assuming that the picture frequency remains the same, the greater the number of lines used the wider the bandwidth required to transmit the signal – the vision bandwidth with the 819-line system is 10MHz, with the UK 625-line system 5·5MHz, and with the old 405-line system 3MHz. Since the broadcasting frequency spectrum is limited, it follows that the number of lines used is a compromise between the number of channels required and the picture definition desired.

It might be thought therefore that the accepted standard of 625 lines represents a practical maximum. Given the bandwidth limitation, any increase in the number of lines used implies a different method of signal distribution – via fibre-optic cable say or a satellite microwave system. This doesn't however mean that there's no incentive at all to develop higher-definition TV systems. 35 and 70mm film stock give superior results since the definition is limited only by the film stock grain: if we want to use TV technology – cameras and recorders – for the production of feature films, then a higher-definition system is required.

High-definition TV is no new idea of course, but it's only recently that a complete system of cameras, recorders, monitors etc. has been demonstrated – by Sony, in prototype form. In 1979 both the BBC and the Japanese broadcasting authority NHK gave details of HDTV systems on which they were working. It's the NHK system that's been taken up by Sony and demonstrated. Table 1 shows the basic specifications of the BBC and Sony/NHK systems, with the UK 625-line system I for comparison.

One of the things to notice is that in addition to an increased number of lines the high-definition systems also use different aspect ratios from the conventional 4:3 – they are wide-screen formats with aspect ratios ranging from 5:3 to 8:3, allowing for Cinemascope type presentation. Another interesting thing from the European standpoint is that the BBC have recommended the adoption of a 30/60 field standard rather than 25/50. This improves the flicker characteristics and opens the door to the prospect of a world-wide standard for HDTV. Current thinking is also that a world-wide colour encoding system should be adopted, probably using digital techniques.

The HDTV system demonstrated earlier this year by Sony features 1,125 lines and 60 fields per second with an overall bandwidth of 30MHz: Sony claim that the system provides resolution equal to 35mm film, and the examples I've seen confirm this claim. The complete system consists of a three-tube camera employing high-resolution Saticon tubes, a one-inch high-density tape RGB VCR, a wideband digital timebase corrector, 20 and 32in. high-definition fine-pitch Trinitron monitors, and a 100in. projection TV unit. Unfortunately the technical details of the colour coding system are rather vague at present.

Such a system could well come into use for movie making and has been enthusiastically received by a number of film people. The speed of editing and the immediacy of the end result are considerable advantages: HDTV would also make it relatively easy to produce special effects that are difficult and/or expensive to achieve using film.

Sony also envisage an intermediate 850-line standard for use as a distribution format for movies etc., while in Europe a 1,250-line system has been proposed giving relatively easy conversion to 625 lines. All pie in the sky? Only time will tell, but I'd like to end with a quotation from the 1943 Hankey report: "In view of the inherent limitations of a TV system based on 405 lines, it is essential . . . for vigorous research . . . to produce a radically improved TV system. TV definition should eventually be in the order of 1,000 lines." That all depends of course on the use to which the system is to be put and the display system.■

Table 1: Systems comparison.

Parameter	*BBC System*	*NHK/Sony system*	*System I*
Lines	1,501	1,125	625
Aspect ratio	8:3	1·33:1 and 1·85:1	4:3
Field frequency	60Hz	60Hz	50Hz
Bandwidth (luminance)	50MHz	20MHz	5·5MHz

All systems use the 2:1 interlace ratio.

Fault Report

Robin D. Smith

WE haven't sold all that many teletext sets to date, but one of the first ones we had from ITT caused us some slight trouble. It was fitted with the 80 series chassis, and on testing it we found that there were slight signs of ringing. We then tried teletext. BBC-1 and -2 were perfect, but ITV would not produce correct displays – the "corrupted" display would correct itself each time after about 25 seconds. Our signals are all right of course, so we suspected the i.f. alignment. There's not much here (CVC850/T panel) to be out of adjustment – just the a.f.c. and vision detector coils, L203 and L204 respectively. Adjusting the a.f.c. coil had no effect on the problems, but slight adjustment of L204 cured them both – the teletext problem and the ringing. Incidentally, the numbers printed on the panel were round the wrong way.

ITT CVC30 Series

We've had our first defective SAWF – in an ITT set fitted with the CVC32/1 chassis. The symptoms were no sound or vision. An interesting fault we had with a CVC30 was a very poor (hardly visible) picture that was pulsing – fast. We got very little help from scope and meter checks since the pulsing seemed to be everywhere. There was one clue however: the stabilised 12V supplies (VII and VIII) obtained from the line output transformer were low at only 8V. It turned out that the 12V rectifier's reservoir capacitor C71 (470μF) had lost capacitance, as a result of which line pulses were getting all over the place. Low, distorted sound on another of these sets was traced to the 470μF electrolytic that couples the audio output to the speaker – all the voltages in the audio circuit were correct. A slightly different set, a 16in. model with remote control (CVC40 chassis), produced a loud buzz from the speaker when in the standby position. Replacing the mains transformer cured that.

ITT CVC9 Chassis

A set fitted with the CVC9 hybrid chassis came in with the complaint no line sync. The fault would come and go with movement of the chassis, but no amount of prodding with the set in the fault condition would show up a dry-joint. Just for the hell of it we changed the flywheel sync discriminator diodes, which believe it or not provided a complete cure. Checks on the old diodes didn't reveal anything amiss – they must have acted funny in circuit.

The next CVC9 presented more of a problem. The line oscillator would start up, but as soon as the boost diode started to conduct the oscillator would shut down. A new PY500A boost diode made no difference. The top caps were removed from the PY500A and PL509 valves and a scope was connected to the PL509's control grid. The shape and amplitude of the drive waveform were correct, and the oscillator ran for some time. Connect the top caps again and the oscillator died. Disconnect top caps and try again. The line drive waveform was present, but after repeatedly switching on I found that sometimes the oscillator wouldn't start. In this condition, applying the AVO to pin 9 (triode grid) of the PCF802 would get the oscillator started. So clearly the oscillator was at fault somewhere. The PCF802 and most of the associated components are on the small "vertical timebase board", but changing just about every relevant component failed to restore correct operation. In the end we had to replace the panel – it's not expensive – to cure the fault. So what was wrong on that board? We can only assume that the print was breaking down somewhere, but would be interested to hear of any other ideas readers might have.

Remote Control Faults

Back to the ITT 80 chassis. The problem this time was with the remote control system – the set worked correctly using the on-board controls, but remote operation was possible only when the transmitter was held within a foot of the set. The infra-red transmitter unit was cleared of suspicion by trying a substitute, so it had to be the remote control receiver unit. Replacing the TEA1009 preamplifier chip restored normal operation.

The TEA1009 was also responsible for a fault we had on a GEC Model C2257H. This time the set was stuck in the standby position, and to cut a long story short we discovered that by removing the small infra-red preamplifier panel (PC981) the set would work manually. Replacing the TEA1009 put everything right.

Excessive Brightness

On another of these sets – Model C2255H, without remote control – the problem we found when we unboxed the set for testing was a white picture with flyback lines and the brightness control having no effect. Chroma was present in the background. So we checked the voltages on the tube base panel, which is where the RGB output transistors are mounted. The power supply arrangement is shown in Fig. 1. There was the correct 900V at plug K1, but only 120V instead of 180V at K2 – the former is the c.r.t.'s first anode supply and the latter the h.t. supply for the RGB output transistors, the earthy end of the first anode potential divider network being taken to the 180V h.t. line. On disconnecting K2 we got a reading of zero volts across C719 – due it turned out to a crack in the PCB at pin 10 of the line output transformer. So there was no input to the 180V supply rectifier D704, but the RGB output stages had been working after a fashion from the first anode supply.

GEC C2110 Series

We've had a couple of the older C2110 series sets in recently. The first was brought in by one of those electronic experts who try to tell you your job. I always point out to such gents that they may know about electronics but are not CTV engineers, in the same sense that I'm not qualified to repair electronic test gear, computers and so on. Anyway, his view was that the decoder was out of alignment (poor colour), and whilst attending to this would I tickle up the convergence as the blue was displaced? Well, I've seen some flat tubes in my time, but this one beat them all. It was absolutely finished. I rang him up to report the news and his reaction was "it never crossed my mind that it could be the tube". A new tube plus setting up produced an excellent picture – maybe the new generation of electronics experts don't appreciate the habits of thermionic devices.

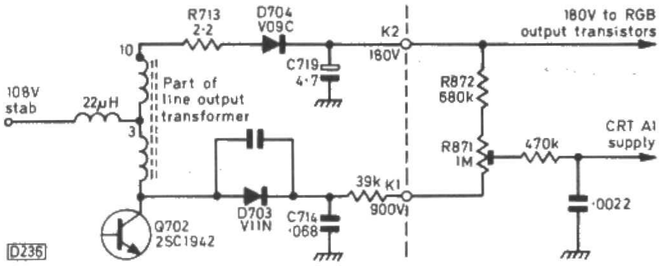


Fig. 1: Method of obtaining the 180V and 900V supplies in the GEC C2055/C2255 series. Q702 is the line output transistor.

Cold shivers went down my spine when the fault on the second C2110 was reported – it was a C2001H with the eight-button light-action channel selector unit, and the customer reported that when the set was first switched on the channel selected would be 8 instead of the normal 1. No amount of button pressing would get the channel required, but if the set was switched on and off repeatedly channel 1 appeared and all channels then changed normally.

I ventured out to the house and switched on. Neon 8 came on and wouldn't change. But wait a minute, there's no sound, hiss or line whistle. Now I'd got it. The line timebase was failing to start, so there were no l.t. supplies. By switching on and off repeatedly, the customer was getting the line timebase to start. On investigation I discovered a dry-joint on one of the connections to the line driver transistor TR401. Resolder, test and everything works correctly. Phew!

Storm Damage

A severe storm can certainly wreak havoc with an unlucky TV set. The following saga relates to a Rank set (A823B chassis with touch tuning) that was brought in after the severe storm last June. On inspection I found the following faults which were put right before switching on: (1) All fuses blown. (2) On-off switch shattered. (3) Mains filter capacitor 8C5 short-circuit. (4) Print a.c. input on customer control panel blown apart. (5) Power supply input print blown apart at plug 8Z1-2. (6) Print at earth screw on i.f. panel blown apart. (7) Tuner unit aerial input blown apart – replace tuner. (8) Diodes 9D23/4 on touch tuner unit short-circuit.

After looking around for other possible faults I refitted the essential panels and using a variac built up the a.c. input. At 160V the d.c. output at the h.t fuse 8F3 was reading 210V while the set e.h.t. control 8RV1 had no effect. Suspect the mains rectifier thyristor 8THY1, and after replacing this achieved a variable 200V h.t. supply with a 240V a.c. mains input. The timebases now worked with correct scanning, but there was no colour. I ignored this for the time being and completed the setting up of the power supply and timebases, using a substitute mechanical tuner.

Attention was next turned to the touch tuner unit (Z916): there were no neons alight, and it wouldn't change channels. There was no negative supply at the junction 9R2/9C17 due to the 68V zener diode 9D27 being short-circuit. With this replaced the neons lit but the channels still wouldn't change. Check 188V supply at 9R39: 188V at one side, zero at the other due to transistor 9VT1 being short-circuit. Replace, restoring the 33V supply. Channels now change, but erratically. Replace the ETT6016 channel selector i.c. and get correct channel changing.

Reconnect the varicap tuner etc., switch on, tune in and find that the stations are drifting badly. Check voltage at the TAA550 stabiliser and find 41V instead of 33V. Replace TAA550 and get correct tuning and a.f.c. operation.

Now to the no colour fault. The ident transistor 3VT11 was open-circuit due to the print problem near the panel earthing. Replace this and get colour, though incorrect. Check voltages around SL917 i.c. All correct except pin 20 which reads zero instead of 9V. Decide to replace i.c. in view of other faults and get correct colour. Set up decoder and i.f. for 600mV U reference signal at 3TP7.

Adjust purity and convergence etc., then soak test. Everything o.k. and a very good picture. This all took some six hours, resulting in a bill of £105 plus VAT. The customer was pleased that we'd been able to get his set working correctly again, and I offered him an invoice so that he could claim on the insurance. Oh dear, he wasn't insured for household contents.

Teletext Lines

In a previous article I mentioned the problem of teletext lines at the top of the picture with these sets (A823 etc. chassis). I said that adjusting the field output stage mid-point bias control 5RV4 would cure the trouble. I've had several cases lately where adjusting the pincushion amplitude control 6RV4 has also cured the problem – this doesn't usually impair the picture geometry.

Green and Purple Bars

We replaced the tube (low emission) recently in another of these sets. After doing this we found that there were large green and purple bars (one of each) across the screen – their position varied with varying brightness levels. With the fault showing at maximum, I disconnected the RGB outputs from the decoder panel in turn. The fault seemed to disappear when the green output lead was disconnected, and I then found that the colour of the bars changed when the green signal was applied to the c.r.t.'s red gun. Was the fault in the green channel or in the SL901 matrixing i.c.? I switched over the red and green outputs from the i.c. by swapping over the connections between the coupling capacitors 3C45 and 3C46 and the red/green channels. Since the fault could still be cleared by disconnecting the green output lead to the c.r.t. the green channel was obviously at fault. Replacing the BF337 green output transistor 3VT8 cured it.

Rank T20 Chassis

Finally on the Rank front, three sets fitted with the T20 chassis. In the first case the customer reported that the set would suddenly shut down after an hour. Switching on and off would bring it back to life. On testing we found that this was indeed the case, and that when the fault occurred the set didn't trip and the 200V output from the power supply to the line timebase was still present. There was no obvious cause for the trouble, i.e. no component failure: the cause was eventually traced to a badly soldered (not visibly so) connection to pin 13 on the line output transformer – the connection that goes to the line output transistor.

The next set was dead and we quickly found that the line output transistor was short-circuit. Replacing it still left us with no results however, due to 5D6 in the EW modulator circuit being open-circuit. This removed the 36V supply and in turn the 12V supply (via the 12V stabiliser) to the line oscillator etc.

The problem with the third set is that 4R42 in the feed to the first anode controls goes open-circuit every four months for no apparent reason. Rank don't know why either. Any suggestions?

Long-distance Television

Roger Bunney

AUTUMN has brought intense signal reception via F2 propagation, from early morning into the afternoon, then changing to trans-equatorial skip propagation – from the south. October also brought an aurora, a spell of Sporadic E and a hint, on the 15-18th, of improved tropospheric propagation. It seems in fact to have been one of the most active autumn months for some years.

The first signs of the return of F2 came on September 29th, when Hugh Cocks (E. Sussex) received ch. E2 signals from Gwelo, Zimbabwe at midday – the PM5544 test pattern. From then on there was F2 reception almost daily, particularly on ch. R1 (49·79MHz) from about 0830/0900 onwards until 1330, with many signals – on the better days the channel would be completely jammed. The usual smeary/multiple image reception made identification difficult. As the morning progresses so the skip distance gets shorter, and by lunchtime it's often possible to see the Baku area EZO test pattern (I managed to identify it positively last year). It has also been possible to receive the Dubai ch. E2 (48·25MHz) transmitter, generally from mid morning through to mid afternoon, though it's occasionally been seen as early as 0900. Several readers have reported a mystery signal floating with the ch. E2 Dubai signal – speculation is that this is either another E2 gulf transmitter or possibly Malaysia. Garry Smith (Derby) for example logged a Popeye cartoon with Arabic subtitles and a second programme on the 15th.

An F2 log for October would be rather repetitive – suffice it to say that signals were present almost daily, mainly on ch. R1. Other highlights during October were as follows:

4/10/81	Dubai ch. E2. N. American amateurs heard at 1540 (BST) using s.s.b. on 50MHz. GBC (Ghana) logged in Cambridge via TE.
5/10/81	ZTV (Zimbabwe) ch. E2 received very strongly over much of the UK via F2 at 1229. GBC E2 received via TE.
6/10/81	GBC E2 (TE); TVP (Poland) R1 (SpE).
7/10/81	GBC and ZTV E2 (TE).
10/10/81	Dubai E2 (F2); RAI (Italy) IA (SpE).
12/10/81	Good SpE opening with RAI IA, B; CST (Czechoslovakia) R1; RTVE (Spain) E2, 3, 4; RTP (Portugal) E3; TDF/TF1 (France) F2 (819 lines).
13-14/10/81	Unidentified ch. E2 signals – GBC/ZTV?
15/10/81	Very strong Dubai E2 at 1000-1350 BST; GBC E2 – both F2.
16/10/81	Dubai and GBC E2.
17/10/81	Dubai E2.
18/10/81	GBC E2 (F2) and RTVE-2 E2 (SpE). SR (Sweden) E2 received via SpE by Paul Barton in Harrogate. F2 very intense this day, the MUF reaching ch. E3 (55·25MHz) at 0850-0905, giving an unidentified pulse and bar/colour bar pattern.
19/10/81	Intense F2 reception again, with Dubai E2 plus floater at 0900 and GBC E2 (TE). Hugh Cocks received ch. A0 (Australia!) from 1105-1110.
20/10/81	ZTV and Dubai E2 (F2). A strong aurora from 1900-2030: Cyril Willis logged ch. E2, 3 and 4 signals whilst Arthur Milliken (Wigan) received vision on chs. A2 and 3 (N. American standard!) – very blurred and with rolling, but a news announcer was seen twice. The signals were confirmed by Ray Davies (Norwich).
21/10/81	Mid morning SpE opening with RTVE E2, 3, 4. GBC E2 (F2). Aurora signals return – very weak on ch. A2 (mid afternoon).
22/10/81	System M signals received on chs. A2/3 (Canada/USA). Hugh logged ch. A2 at 1340 with a pulse and bar/colour bar pattern for twenty minutes. Arthur Milliken also logged chs. A2/3 (weak) in the late afternoon. GBC E2 (TE).
23/10/81	Very strong ZTV E2 (F2); GBC E2 (TE).
27/10/81	Ch. A0 received at noise level (by Hugh Cocks using an SX200 scanner).
28/10/81	Two ch. A0 signals with locked video received here at Romsey from 0855-0930. At 0904 the New Zealand ch. 1 video (45·25MHz) was heard, using a scanner, but there was too much interference from USSR signals to be able to lock the video. The ch. A0 signals were strong and were received over a wide directional range from the east through to the north. NTV (Nigeria) Sokoto ch. E3 noted in mid UK at 1100.
29/10/81	Ch. A0 received by Hugh Cocks from 0830-1000 – prolonged but very weak. SpE reception from TVP and TSS (USSR), both on ch. R2.

Another mystery – a low-level signal on ch. E2 during African openings. Michel Dubernat (S. France) suggests that it's from Equatorial Guinea.

Our Australian friends also report excellent results. Anthony Mann (Perth) received the BBC-1 Crystal Palace transmitter plus other transmitters with sound offsets on October 1/3/6/11th.

So October has certainly been above average, and the strength of many of the signals, particularly the Russian ones on ch. R1, has been sufficient for reception using even the most basic equipment. The use of a narrow-band scanner (such as the SX200N) is invaluable for seeking weak video signals that would be lost using a wideband i.f. TV receiver strip. The device certainly gave early warning that ch. A0 was on the way, and the NZ ch. 1 vision would never have been resolved on even a narrow-band TV i.f. strip. I've programmed the SX200's sixteen memories with most of the Band I vision carrier frequencies, and it's very easy to scan across the band quickly to check whether any vision signals are present before switching on a TV set.

The above log was compiled from reports sent in by Hugh Cocks (E. Sussex), John Cowan (Ayr), Paul Barton (Harrogate), Cyril Willis (Ely), Arthur Milliken (Wigan), Garry Smith (Derby), Andrew Tett (Surbiton), Gareth Foster (Middlesex) and Jim Cook (Newcastle). Many thanks.

Finally, going back a bit Mark Baldwin (Rugby) reports excellent Band III meteor scatter reception during August – he received noise-free pings from Poland on the 11th (ch. R9) and the 14th (R10).

Meteor Showers

Paul Barton has obtained from the meteor section of the

BAA the dates and peaks for the main 1982 meteor showers. The details are as follows:

Quadrantids	January 1-5th, peaking on the 3rd.
Lyrids	April 19-24th, peaking on the 21/22nd.
Delta Aquarids	July 15th-August 15th, peaking on July 28th.
Perseids	July 25th-August 17th, peaking on August 12th.
Orionids	October 17-26th, peaking on the 21st.
Taurids	October 20th-November 20th, peaking on November 3-8th.
Leonids	November 14-20th, peaking on the 17th.
Geminids	December 7-15th, peaking on the 13th.

News Items

W. Germany: 31 of the ZDF (W. German second channel) transmitters are now transmitting dual-channel sound, covering 65% of W. Germany. All 90 ZDF transmitters will be capable of dual-channel sound transmission by the end of 1982. ARD (the first programme network) won't be so equipped until two-three years' time. Plans for the third network haven't so far been announced but since, like the ZDF, their transmitters are operated by the W. German PTT (ARD run their own transmitters) it's likely that some at least will eventually be equipped for dual-channel sound. Our thanks to Alexander Wiese for this information.

Eire: George North reports that there are three low-power "pirate" TV stations in addition to the Dublin one previously mentioned. These are Waterford Local TV (owned by Waterford local radio), Tele Limerick, and Leeside TV (Cork). In addition, TV Down in Northern Ireland apparently relays RTE-1 into Newry. No other information on these stations is available.

India: TV broadcasts from the Russian Ekran-7 satellite at 99°E on 714MHz have been extended from 1145-2100 Madras time with apparently increased power – improved quality pictures are being received in Madras, using stacked Yagi aerials. The opening test pattern is at 1130-1145, followed by world news at 1145-1200. Another twelve main TV centres equipped for colour are planned during the next five-year Indian plan, and New Delhi is to have a 250m high TV tower.

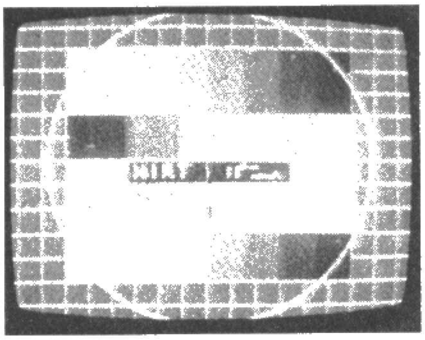
Holland: The attempt by several US film producers to serve an injunction ordering an Amsterdam cable company to switch off its distribution equipment following nightly "close down" has failed. The aim was to prevent pirates injecting programmes with feature films into the cable networks via the head-end aerial equipment.

Africa: Zimbabwe hopes to start colour transmissions in the autumn of 1982. A TV service for Namibia is being planned.

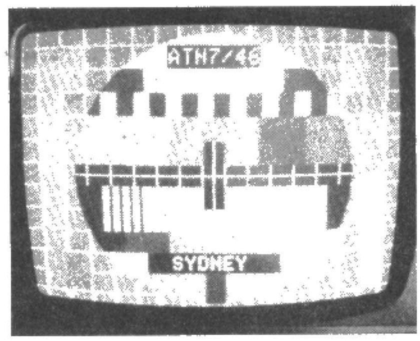
UK: The IBA is already carrying out test transmissions for the TV4 service. Several readers have reported that Winter Hill has been transmitting the IBA electronic test pattern with the identification "IBA Channel 4" on ch. 65.

Subscriptions

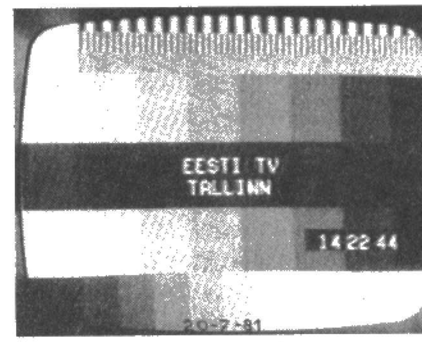
The time has come to renew subscriptions to the highly recommended EBU "List of European Television Stations" and its six bimonthly supplements. For the latest issue (no. 25) send 750 Belgian Francs by means of a bank draft to the European Broadcasting Union, Technical Centre, 32



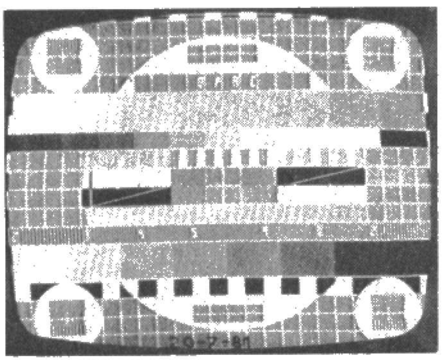
The Iranian FUBK test pattern (Abadan ch. E7) received in Finland by Petri Pöppönen.



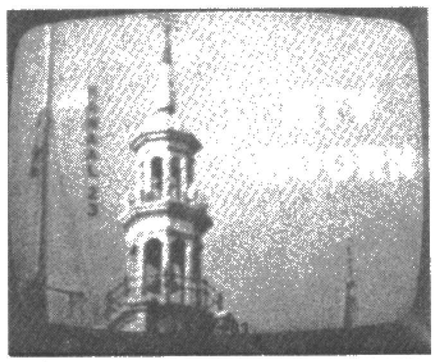
Ch. A7, Sydney, Australia PM5544 test pattern. Photographed by James Burton-Stewart during a recent visit.



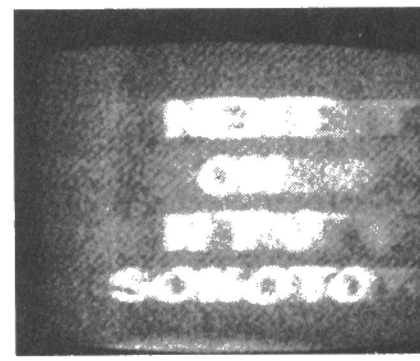
Tallinn ch. R2 (USSR) test pattern received in Holland last August by Ryn Muntjewerff.



Leningrad ch. R3 test pattern received by Ryn Muntjewerff. Note identification at top.



A new Dutch pirate TV transmission, on ch. E23. Photograph from Ryn Muntjewerff.



Nigeria ch. E3 received by Michel Dubernat in the south of France via F2 propagation.

Avenue Albert Lancaster, B-1180 Bruxelles, Belgium. Geoffrey Falworth of 12 Barn Croft, Penwortham, Preston PR1 0SX produces an extensive Roneoed news data service covering commercial, military and so on space satellites. The technical information is detailed, covering both eastern and western craft. For samples etc. send 20p in stamps plus an s.a.e.

Multi-standard CTVs

Malcolm Pugh has drawn our attention to a company which supplies multi-standard colour sets suitable for use in any country using the PAL, Secam and/or NTSC systems (but not the obsolete 405- and 819-line systems). Switching from standard to standard is automatic, and the range includes receiver/monitors. I've not had an opportunity to try out one of these sets, but Malcolm speaks highly of the company and its after sales service. The prices are "up-market". For information, send to SPT Video Ltd., Unit 1, Heybridge Industrial Estate, Holloway Road, Heybridge, Maldon, Essex CM9 7XS.

From our Correspondents . . .

James Burton-Stewart has been on holiday in Australia recently where he experienced antipodean DX-TV at Todd Emslie's home in Sydney. He reports that many local and semi-local signals could be picked up. A copy of *The New Straights Times* he obtained gives the times of Malaysian programmes as follows: Network-1 1700-0022, Network-2 1730-1102.

Petri Pöppönen (Lahti, Finland) reports that the Tampere ch. E2 transmitter finally closed on September 1st. He's sent us a shot of an Iranian test pattern – interestingly, the identification differs from a similar photo sent in by Bud Lloyd-Bennett (Dhahran, S. Arabia) who received the pattern via tropospheric propagation on ch. E9.

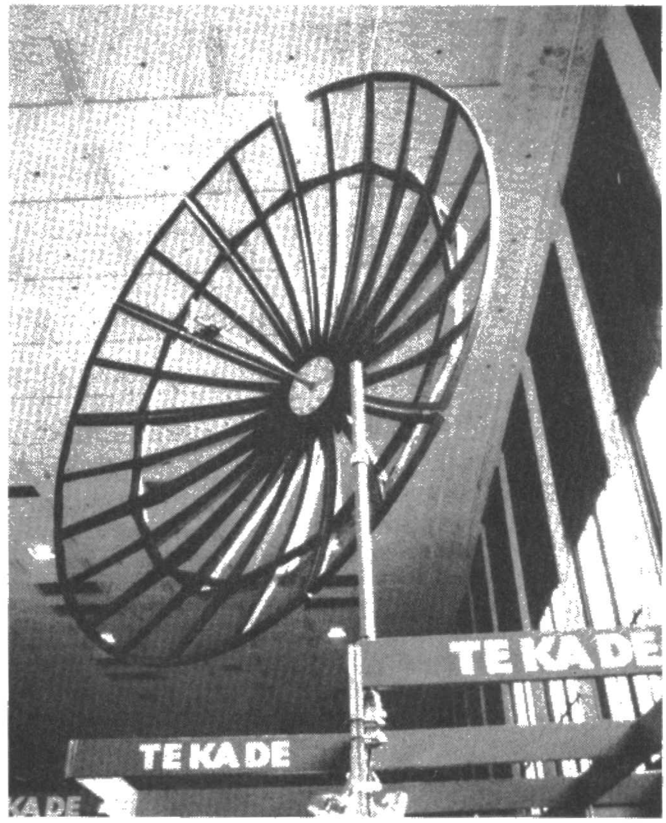
Gareth Foster reports on a holiday in Tokyo. The TV there is similar to the USA, but NHK runs two non-commercial channels. Seven v.h.f. channels and one u.h.f. channel are used in Tokyo, with dual-channel sound for stereo or bilingual dubbing – most channels carry an English translation of their evening news broadcasts. The second sound channel uses a 31·5kHz (twice line frequency) f.m. subcarrier which is frequency modulated on to the main sound carrier (the f.m. + f.m. system). The audio response is quoted as 50-14,000Hz, with a stereo signal separation of 30dB. A second low-level 55·125kHz subcarrier is modulated at 922·5kHz to indicate a bilingual transmission or 982·5kHz to indicate a stereo transmission. Most sets fitted with dual-sound decoders have red/green LEDs to indicate stereo/bilingual transmissions and a switch for the second sound channel.

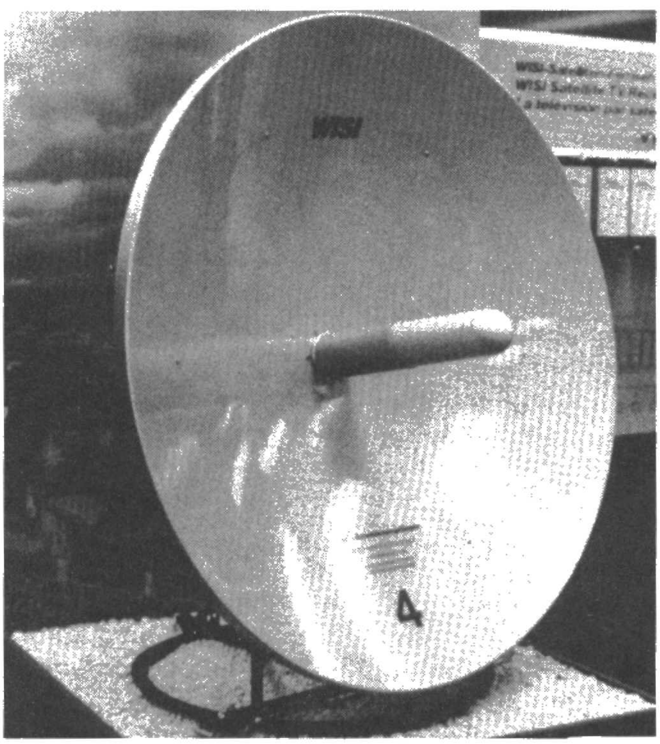
John Ballantyn has sent us more detailed information on mains input filtering to avoid CB interference. Slide two FX1588 ferrite rings along the mains lead to the back of the TV set or f.m. radio receiver, then take some ten turns of mains cable around the ferrite – that's all! It also apparently cures the sound i.f. interference in the Philips G11 chassis reported under the heading "Service Briefs: Philips" on page 649 of the October issue, and VCR breakthrough problems.

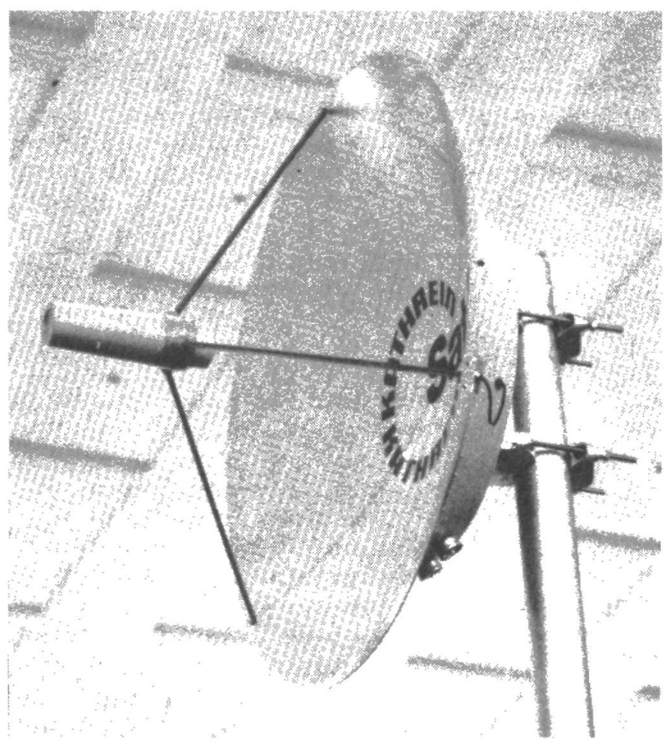
New DX-TV Equipment

I've recently been installing new DX-TV receivers (four) to replace the ageing Bush TV125 sets that have given good service for over a decade. The basic receiver is the Thorn 1690/1 chassis, to which a front-end unit with switchable wideband/narrow band i.f.s has been added. Though made specifically for use with the 1690/1 chassis, these units can be used with other sets. All tuning units are being fitted with ET021 tuners. Full details will be given in the next two issues.

The shape of things to come . . .







Alexander Wiese writes from Munich: Dish aerials for satellite reception were a feature of the recent Berlin International Audio and Video Fair. Some examples are shown above. At the top left, a Fuba 3m s.h.f. dish. At the top right a 3m dish for u.h.f. reception: this TeKaDe aerial gives wideband coverage with a power gain of 24dB – it's pricey at 15,000 DM. At the bottom are 0·9m s.h.f. dishes from WISI (left) and Kathrein (right). The dish is used to concentrate the signal at the focal point. The actual receiving element may be mounted here or the focused signal may be reflected back through a hole in the centre of the dish to the receiving element. The latter technique is usually called a Cassegrain aerial – the WISI aerial shown above is of this type (the others have the receiving element at the dish's focal point). A duplexer is required to discriminate between left-hand and right-hand polarisation. The design of duplexers seems to be a problem – only a few firms had usable prototypes on show. Special programmes were sent via the OTS satellite during the Fair so that satellite equipment could be demonstrated working.

VCR Servicing

Part 5

Mike Phelan

LAST month we followed the course of the luminance signal on playback as far as IC5, which provides h.f. enhancement and adds the chroma signal. Now for a little more detail on this (see Fig. 27). The luminance signal enters IC5 at pin 18, passing to an emitter-follower stage whose output appears at pin 1. This output is a.c. coupled to pin 16, passing through an amplifier to the internal luminance/chrominance (Y-C) mixer. The 4·43MHz chroma enters the chip at pin 15, and the composite video emerges at pin 8 – after passing through a squelch or mute stage which is included to blank out the video when the machine is in the pause or stop mode, opening to pass the signal only when the tape is threaded up and the machine is in the record or play mode.

The loss of the higher video frequencies during recording and playback would result in a very "soft" picture were it not for the circuit consisting of transistor X6 and the associated components. This is called the aperture circuit, and works as follows. The high-frequency components of the signal are separated by the high-pass amplifier in IC5 (in conjunction with some external components) and then limited (to remove overshoots), passing from pin 3 to the base of X6. This transistor is operated as an emitter-follower, driving a diode filter network. A proportion of the output is tapped off via the aperture control and reinserted via pin 13 of IC5. With the gain provided by the high-pass amplifier, the signal's h.f. components are thus enhanced. There's a snag to this however: if we boost all the h.f. signal components, low-level h.f. signals such as noise, blemishes on faces etc. will stand out, giving the picture an unreal, plastic effect. This is the reason for including the four diodes: signals below 1·2V peak-to-peak are prevented from passing through the aperture circuit, so that low-level h.f. components do not receive enhancement.

UHF Modulator

The output from pin 8 of IC5 goes to the u.h.f. modulator, or r.f. converter as JVC call it. This is roughly the size and shape of a tuner unit. It contains a u.h.f. oscillator, which is usually in a screened compartment and is adjustable over a few channels by means of a trimmer. The centre frequency is at about channel 37, but if this is one of the local channels adjustment will be necessary to remove patterning from the picture. The oscillator is modulated by both the composite video and the sound carrier (6MHz, frequency modulated) – the sound carrier is produced by the modulator, and there's a coil to adjust its frequency (this is sometimes necessary with a new machine where it has been set at 5·5MHz). There are also presets in the modulator unit for adjusting the depth of modulation: before twiddling, it's best to compare the results with those obtained from a known good modulator (they plug in).

Recording the Chroma Signal

Now to the chroma circuitry, in the record mode first. We start with the 4·43MHz chroma signal from the i.f. strip or the video camera input. The luminance part of the composite video signal is prevented from entering the chroma channel by bandpass filter BPF201.

To recap on the basic chroma system, see Fig. 28 (refer to Fig. 11 for the overall block diagram of the machine). On record, the incoming 4·43MHz chroma signal is mixed with a 5·06MHz carrier, the difference signal (626·9kHz) being recorded on the tape. On playback, the same 5·06MHz

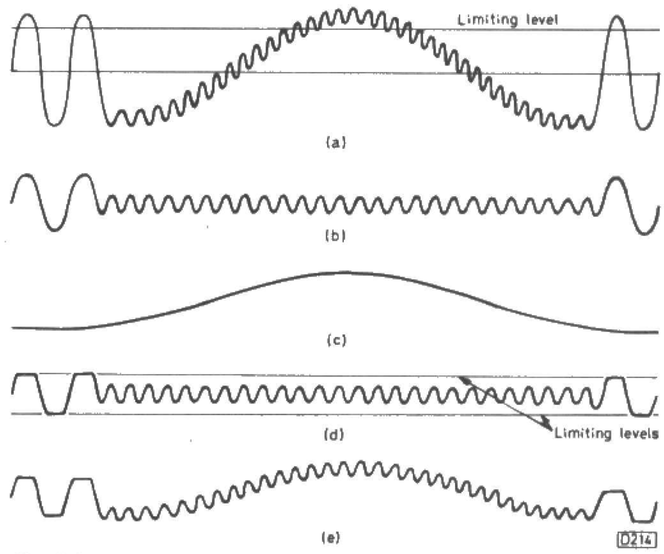


Fig. 26: Luminance signal limiting – see last month. (a) Signal with low-amplitude, high-frequency component. (b) Output from the high-pass filter. (c) Output from the low-pass filter. (d) Output from the limiter. (e) Addition of outputs (c) and (d).

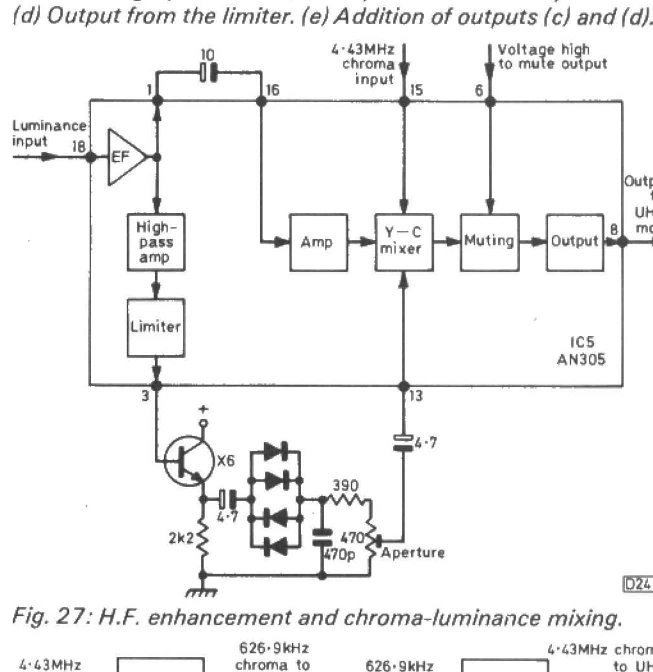


Fig. 27: H.F. enhancement and chroma-luminance mixing.

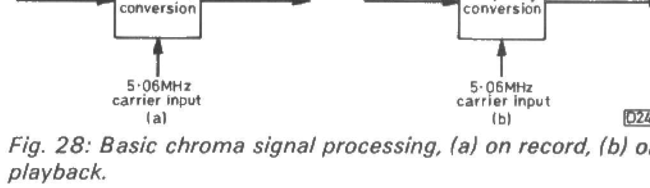


Fig. 28: Basic chroma signal processing, (a) on record, (b) on playback.

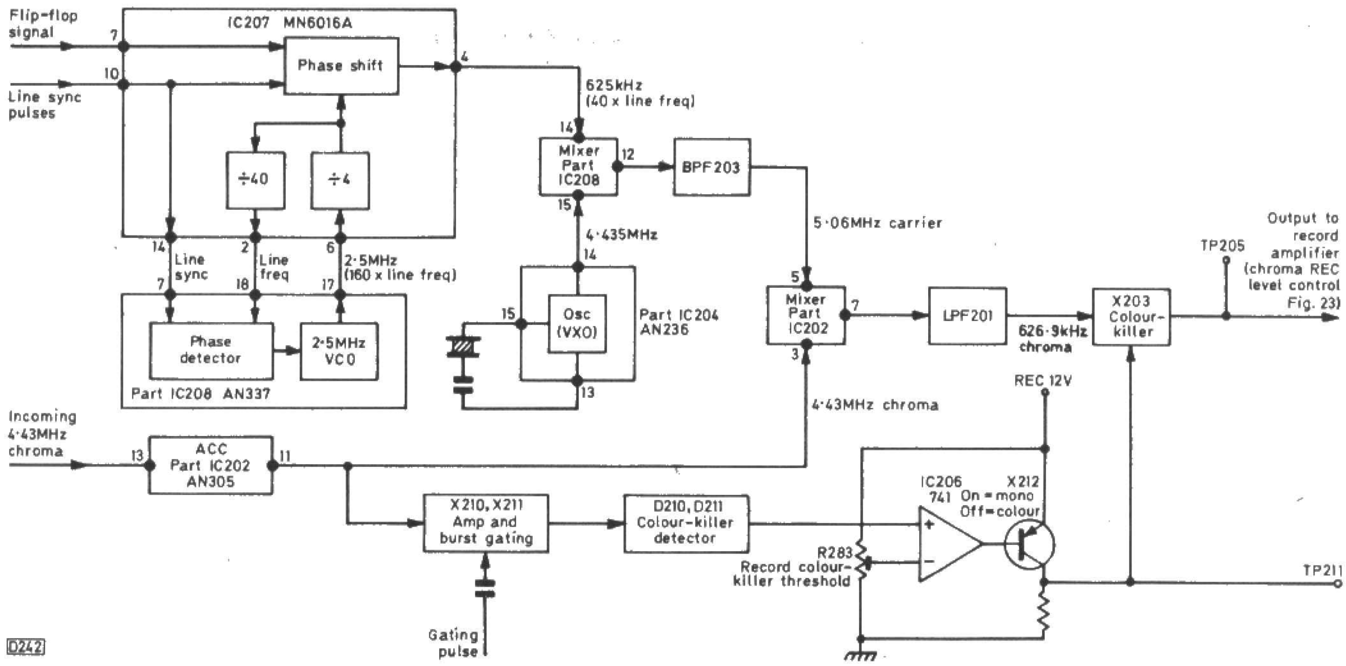


Fig. 29: Chroma signal processing arrangements on record.

carrier is used to perform conversion back to 4·43MHz. Things are not as simple as this however, for several reasons. For a start, the 5·06MHz carrier must be locked to something on record, whilst on playback variations in tape speed etc., including those that occurred during recording, must be compensated for – otherwise there would be gross phase errors. Finally there's the problem of crosstalk between adjacent tracks on the tape.

Crosstalk

The gaps in the two heads in the video drum are tilted by 6° in opposite directions (this is known as the slant-azimuth technique). As a result of this 12° azimuth difference, if one head reads the information recorded by the other head there's a severe loss of the higher frequencies, i.e. crosstalk at the luminance f.m. carrier frequency (3·8-4·8MHz) is minimized. At the lower frequency of the chroma carrier (626·9kHz) however the slant-azimuth arrangement gives little crosstalk attenuation, so that something else has to be done to prevent chroma crosstalk between tracks. We'll return to this shortly.

Chroma Signal Processing

Fig. 29 shows how the 5·06MHz record carrier is generated. First, looking at the left-hand side of the diagram, there's a phase-locked loop which produces a 625kHz carrier locked to the incoming line sync pulses.

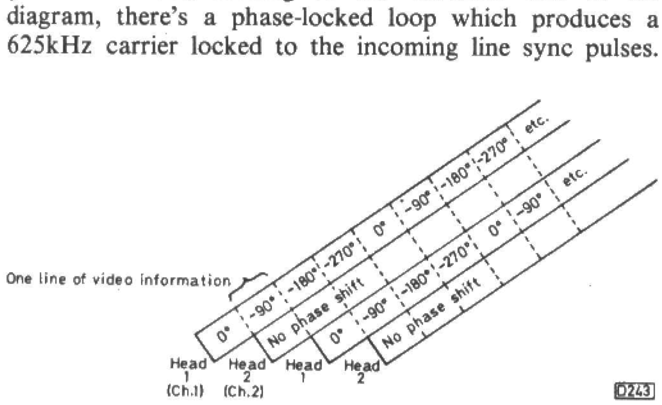


Fig. 30: The head 1 chroma signal is phase shifted by 90° line by line to avoid chroma crosstalk between adjacent tracks.

Ignore the bit labelled phase shift for the moment. IC208 contains a voltage-controlled oscillator (VCO) running at 2·5MHz (160 times the line frequency, or 160fH for short). Its output is divided by 4 and then by 40 (in IC207) to give, you guessed it, the line frequency. Back in IC208 the phase detector compares the line sync input and the counted down line-frequency signal, the output error voltage thus produced being used to control the 2·5MHz VCO. That bit is simple enough. The divided-by-four (625kHz) signal (40fH) is then mixed with the 4·435571MHz output from a crystal controlled oscillator (VXO), BPF203 extracting the 5·060571MHz sum-frequency output. This is our chroma carrier, which we mix with the incoming 4·43MHz chroma in IC202.

The 626·9kHz difference-frequency signal, i.e. the frequency-converted chroma signal, then passes via LPF201 and the killer stage X203 to the record current amplifier. X203 is turned off in the absence of chroma – the killer control voltage is obtained in the usual way, by using a rectifier circuit (D210/D211) to rectify the burst signal following burst gating (X211).

The VXO is free-running during recording. This gives a continuous phase shift of the chroma signal being recorded on the tape – compensation for this occurs during playback.

Phase Shifting

Finally this month back to the bit labelled phase shift in IC207. As previously mentioned, we need some method of preventing chroma crosstalk between tracks on playback, i.e. the "channel 1" head must not be able to reproduce the chroma signal recorded by the "channel 2" head and vice versa. We will consider next month what's done on playback to ensure that this is so: for now we must simply state that the chroma recorded by head 1 is shifted in phase by 90° line by line – see Fig. 30. To do this the phase shifter requires a line sync input and also a drum flip-flop input, the latter to ensure that phase shifting occurs on alternate fields only, i.e. on head 1 tracks but not head 2 tracks.

We feel that you deserve a break after this, and hope that all those frequencies haven't caused too much confusion. Next month we'll be dealing with the chroma playback process.

TV Receiver Design: The Decca/Tatung 120 Series

Part 3

Ray Wilkinson

WHEN we were thinking initially of a low-cost, small-screen portable we considered the pros and cons of using a series stabiliser with a mains transformer for the power supply. We finally decided upon the use of a non-isolated, free-running switch-mode power supply based on the now well known Siemens design. The circuit we adopted uses a control i.c. (type TDA4600) which Siemens have developed for use with this type of power supply.

Power Supply Operation

A simplified circuit of the power supply is shown in Fig. 13. The output section consists of the chopper transistor Q801 and its load transformer T801. It operates as a flyback converter, the energy stored in T801 when the chopper transistor is conductive being transferred to the load (i.e. the TV set) when the chopper transistor switches off. Fig. 14 shows the basic waveforms. The diode bridge D801-4 charges the reservoir capacitor C804 from the mains – note that the positive plate of this capacitor is connected to the receiver's chassis, as a result of which the power supply circuitry is at some –300V with respect to chassis. Most of us have had at least one belt from this arrangement during development, so be warned! Don't think you're out of trouble when the set is switched off either, because C804 retains its charge. We added a 180kΩ, 1W resistor across C804 to provide a discharge path when the set is switched off, but this still takes a few seconds. So check with an AVO before diving into the chassis – the heatsinks for the chopper transistor and the control i.c. are both connected to the negative supply line.

Back to circuit operation. When Q801 switches off, its collector voltage flies up until the rectifier diodes D811 and D812 conduct, charging their reservoir capacitors C821 and C822 + C826 from the energy stored in the transformer. After a while the energy begins to run out, the field around the primary winding starts to collapse, and the chopper transistor's collector voltage starts to fall – see Fig. 14(a). The shape of the waveform at this point resembles part of a sinewave, C817 acting as a tuning capacitor. The feedback winding (II) on the transformer feeds a smaller, inverted version of this waveform – see Fig. 14(b) – to pin 2 of the control i.c., via R814. Within the i.c., a zero-crossing detector senses the point at which the feedback waveform crosses the 0V line (mean level). When this occurs, logic circuitry in the i.c. switches on the base drive current to the chopper transistor, via pin 8 and R804. Q801's collector current then rises linearly – see Fig. 14(c) – since it's driving an inductive load.

Q801's on time depends on the mains voltage and the load conditions – in other words on the amount of energy required to maintain the output voltages. The transistor is turned off by a current flowing via pin 7 of the i.c. – see Fig. 14(d). The cycle is then repeated, the frequency of oscillation and the mark-space ratio altering with mains voltage changes and load variations. L802, R811 and D807 are included to improve Q801's turn-off behaviour.

Fig. 15 shows the method of stabilization in greater detail. In addition to providing zero-crossing information, the transformer's feedback winding also provides the i.c. with a sample voltage (at pin 3) that's proportional to the output voltage. An internal 4V reference voltage is potted down to 2V and forms one of the inputs to the differential amplifier behind pin 3. The reference voltage also appears at pin 1, where it's applied to a resistive chain (R806/807/812/813) which has the rectified sample voltage

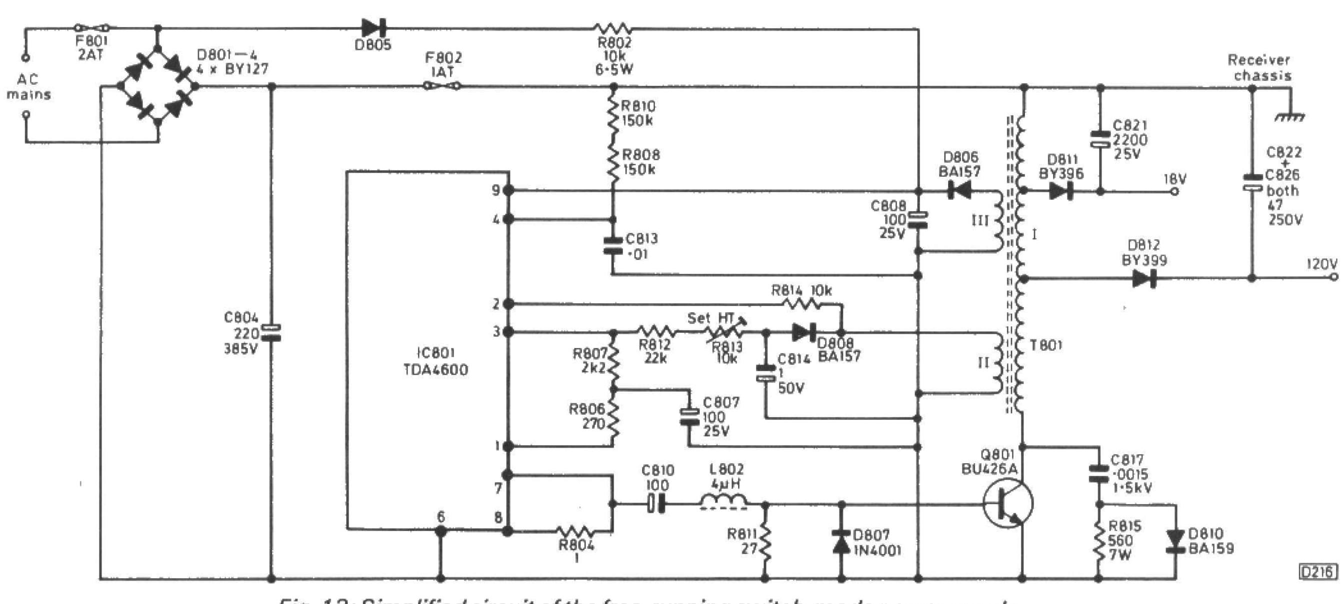


Fig. 13: Simplified circuit of the free-running switch-mode power supply.

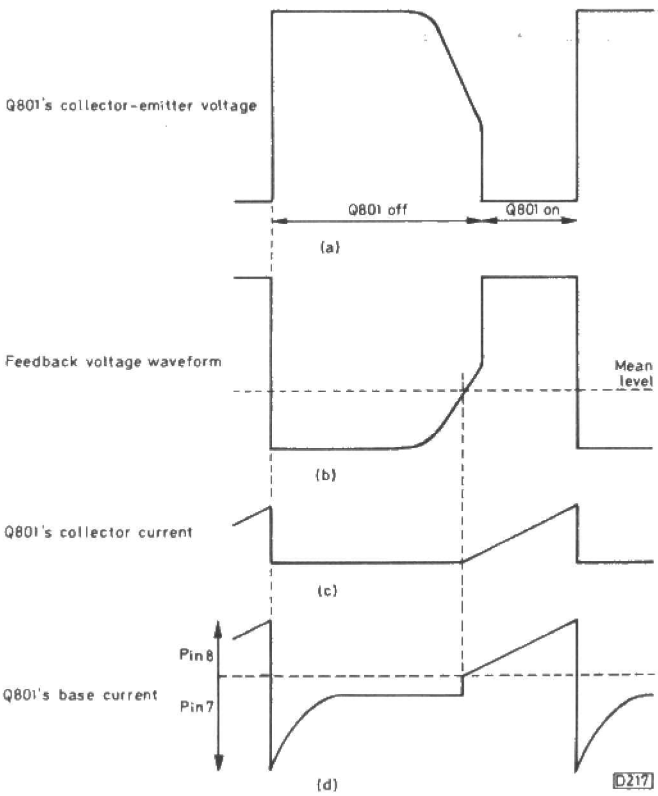


Fig. 14: Switch-mode power supply waveforms.

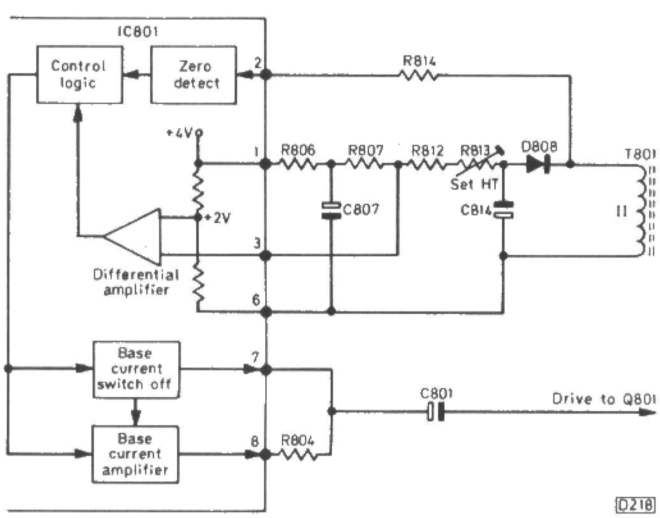


Fig. 15: Output voltage regulation.

at the other end – across C814. The differential amplifier's output forms part of the control logic within the i.c., and by adjusting the chopper transistor's on time holds its two inputs at the same voltage. The output is thus stabilized, at a level determined by the setting of R813. C807 provides a slow-start action at switch on to avoid uncontrolled switching surges in Q801.

We mentioned earlier that when Q801 switches on its collector current rises linearly. To avoid its base over saturating – which would slow down the current turn-off – the i.c. provides a linearly rising base current drive, as shown in Fig. 14(d). In order to sense how much drive to provide, the *RC* network R808/R810/C813 feeds a sawtooth voltage to pin 4 of the i.c. The voltage across C813 is proportional to Q801's collector current and to the mains voltage. If the mains voltage increases for example, Q801's collector current will rise at a greater rate: the slope

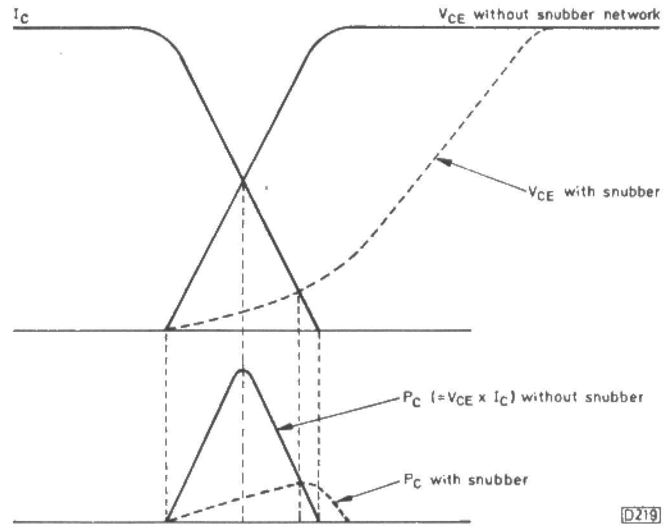


Fig. 16: Use of a snubber network to reduce the power dissipation in the chopper transistor when it switches off.

of the sawtooth across C813 will also increase, telling the i.c. to increase the slope of the base drive fed out at pin 8.

The remaining aspects of the power supply are straightforward. The i.c.'s supply is obtained from winding III on the transformer, via the rectifier circuit D806/C808. D805 and R802 provide a start-up feed.

R815 and D810, in conjunction with C817, slow down the rise in Q801's collector voltage when it switches off. This is a common technique (snubber or dV/dt network) for reducing the switch-off dissipation in power switching transistors – see Fig. 16.

The two power supply output voltages are 120V (152V in the 130 chassis) for the line output stage and 18V. The 18V line is further stabilized down to 12V to provide a clean, low-impedance supply for all the low-voltage circuitry in the receiver. The audio circuit is operated directly from the 18V supply – in this way a reasonable audio power output can be obtained without any picture bouncing.

The power supply is protected under all sorts of fault conditions. In general, if an overload or short-circuit occurs on the output lines the output power is limited by the i.c. lowering the operating frequency from the normal 25kHz or so and by reducing the mark-space ratio. A fault condition in the receiver can often be detected by the audible whistle that then comes from the supply.

The performance of this power supply is excellent, and our tests indicate that it's very robust. Over a mains input range of 150-270V, the 120V output changes by less than 0·6V

Acknowledgement

Finally I would like to thank all my colleagues in the development team at Bradford for their valuable assistance in the preparation of these articles, and the management of Tatung (UK) Ltd. for permission to publish them. I'd better stress however that any opinions expressed – and occasional lapses into frivolity – are my own.

Due to an editorial slip, mention was made in Part 2 last month to the "first anode controls" in connection with setting up the black level etc. There's only one first anode control in the 120 chassis of course since it uses a PIL-type tube. Although the 30AX tube used in the 130 chassis has separate first anode pins for the three guns, the tube tolerances are sufficiently tight, and the range of the video circuit presets sufficiently wide, to enable a single first anode control to be used in this chassis as well. ■

Servicing Skantic PSU Modules

John Brown

THE main concern of the present article is servicing the power supply module used in the Skantic 4751/5151/5661 group of models. These sets were imported from Sweden in fair quantities around 1976. The solid-state chassis makes extensive use of plug-in modules, and employs the Toshiba RIS tube which gives a very good picture – it's an in-line tube with 110° deflection. The notes that follow are based on two years' intensive experience of repairing a large number of modules belonging to these sets. The regulated power supply uses the self-oscillating chopper system originally devised by Siemens.

Access

The front control panel can be hinged downwards by inserting a flat-bladed screwdriver in the horizontal slot at the top: lever upwards gently to release the internal plastic catch. To remove the back cover, insert the same type of screwdriver in the two slots along the lower edge: this time lever carefully downwards to release the catches.

Having removed the back, you'll be confronted with the print side of the two main panels. The one on the left is referred to as PCB1 and carries the plug-in modules for the signal circuits: the one on the right is PCB2, which contains the line output stage and plug-in modules for the field timebase and the line oscillator/sync circuitry. The switch-mode power supply is enclosed in the metal casing between these two panels, beneath the tube neck. The two main panels can be hinged outwards after removing the screws from the plastic brackets on the top of the power supply casing.

To gain access to the switch-mode power supply, remove the self-tapping screw from the top centre of the vertical cover plate. On *no account* put your fingers underneath the power supply module, since under certain fault conditions the mains bridge rectifier's reservoir capacitor CN03 (400µF), which is mounted on this module, retains its charge for a very long time. Slide the module towards you, removing the three- and five-pin plugs as you do so. Discharge CN03 via a 330Ω resistor – shorting with a screwdriver serves only to burn away a section of the printed circuit.

Mains Input

The mains input circuit is situated at the lower end of the channel switching panel. The on-off switch connects the mains supply to a bridge rectifier (DQ04/5/6/7, see Fig. 1) which supplies a negative 290V feed to the switch-mode power supply. There are 3·15A anti-surge fuses in both the live and neutral leads, and the chassis is always at half mains potential. DQ08 supplies start-up pulses for the chopper transistor TN03.

If the 3·15A mains fuse(s) is/are blown, check the bridge rectifier diodes. Replace with BY127s or similar. Also inspect the mains filter choke LQ01, as this sometimes arcs – if necessary, replace.

Chopper Operation

The chopper transistor TN03 is connected between chassis and the −290V supply via the primary winding (tags 2-12) of the chopper transformer and RN09. When the transistor switches off, tag 2 on the transformer swings positively and the rectifier diodes DN07-DN10 conduct, supplying current to the four output supplies which are designated N1-4. TN03 and transformer LN03 form a free-running oscillator: when tag 7 on the transformer swings positively, TN03 switches on.

Regulation is achieved by switching TN03 off at an earlier point in the cycle than it would if left to free run. The switch-off action is provided by thyristor TN02, which shorts the base and emitter of TN03 via CN08 and RN09 when it fires. The time at which TN02 fires is controlled by its gate circuit. DN04 charges CN05 to provide the basic gate bias, which is modified by the conduction of TN01 and hence the voltage developed across RN05. When TN03 conducts, a ramp is developed across RN09: this is applied to the gate of TN02, the point along the ramp at which it fires depending on the d.c. bias conditions. The voltage across the reference winding (tags 1-3) of the transformer is rectified by DN03, this voltage being used to control the conduction of TN01.

To get the circuit started, positive-going mains frequency pulses from DQ08 are fed via RN11 and CN09 to the base of TN03. The circuit's switching frequency is determined by the load requirement and lies between 22-42kHz.

Fault Finding

The most common fault is TN03 going short-circuit – a first indication of this is a black looking fuse (FN01, 1A quick blow). When you encounter this situation, discharge CN03 through a resistor, remove TN03 and TN02 from the circuit, and test the output rails for short-circuits. Check DN03, RN08, CN04, DN01, TN01 and CN08 for possible

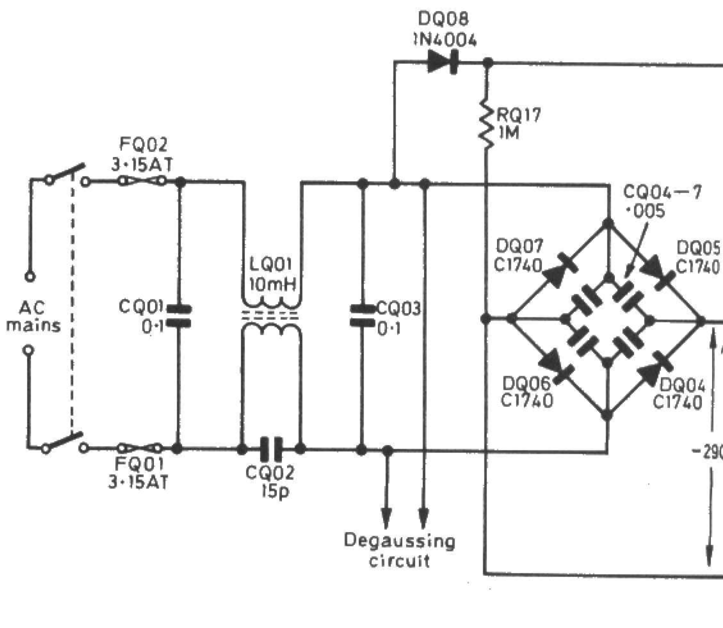


Fig. 1: The mains input and s

short- or open-circuits – they can be tested initially without being removed. If any are suspect, remove them for final test. Use a BU326 as a replacement for TN03 – whenever it has to be replaced because it's short-circuit, TN02 must also be replaced (suitable types BRY55, BR103, MCR101 or W2113).

After doing this reconnect the power supply module – the wiring is long enough to allow this to be done without returning the module to its casing. Recheck the output rails for possible short-circuits in other parts of the set, turn PN01 anti-clockwise, monitor the 160V output and switch on. The result should be a slightly dark and slightly narrow picture. If a fault is still present the trip circuit will operate. If all is well, set the 160V rail by means of PN01 with zero beam current.

If fuse FN01 is intact and TN03 is not short-circuit, check the fusible resistor RN14. If it's open-circuit, the trip has operated. This usually means that the output voltages have gone high due to a fault in the sensing circuit. Carry out resistance checks on TN01, TN02 and the associated components – the main suspects are DN03 and CN04 for short-circuit, or DN03/RN08/CN08 for open-circuit. If RN03 shows signs of having over heated, replace TN01 and DN01. Then remake RN14, turn PN01 anti-clockwise, monitor the 160V rail and switch on.

Low output voltages from the module occur when TN02's gate voltage is too high – the thyristor then switches on too soon, in turn switching TN03 off too soon. Check the voltage across CN05. If this is low or missing, CN05 could be leaky or short-circuit. Check the forward resistance of DN04 and DN06. A similar fault, sometimes intermittent, can be caused by DN05.

Absence of the –290V feed to the power supply module can be the result of RN04 being open-circuit – this resistor is also prone to dry-joints, sometimes burning a hole in the board.

No starting pulses at the base of TN03 will give the dead set symptom. Check CN09 and RN11 on the power supply module and DQ08/RQ17 in the mains input circuitry. A quick test is to connect the red lead of an AVO to chassis (on the resistance range) and then tap the base of TN03 with the black lead: providing the rest of the module is working satisfactorily, the power supply should then start.

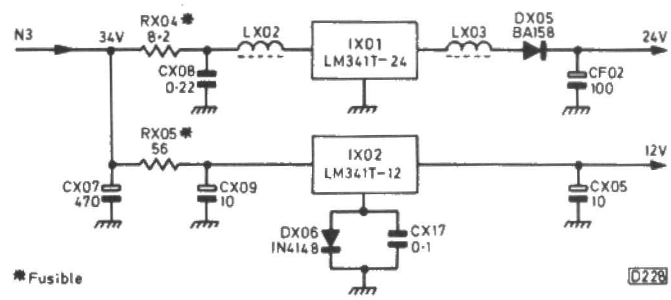


Fig. 2: The 12V and 24V regulators. In earlier versions RX05 was fed from the cathode of DX05 – RX05 is then 39Ω.

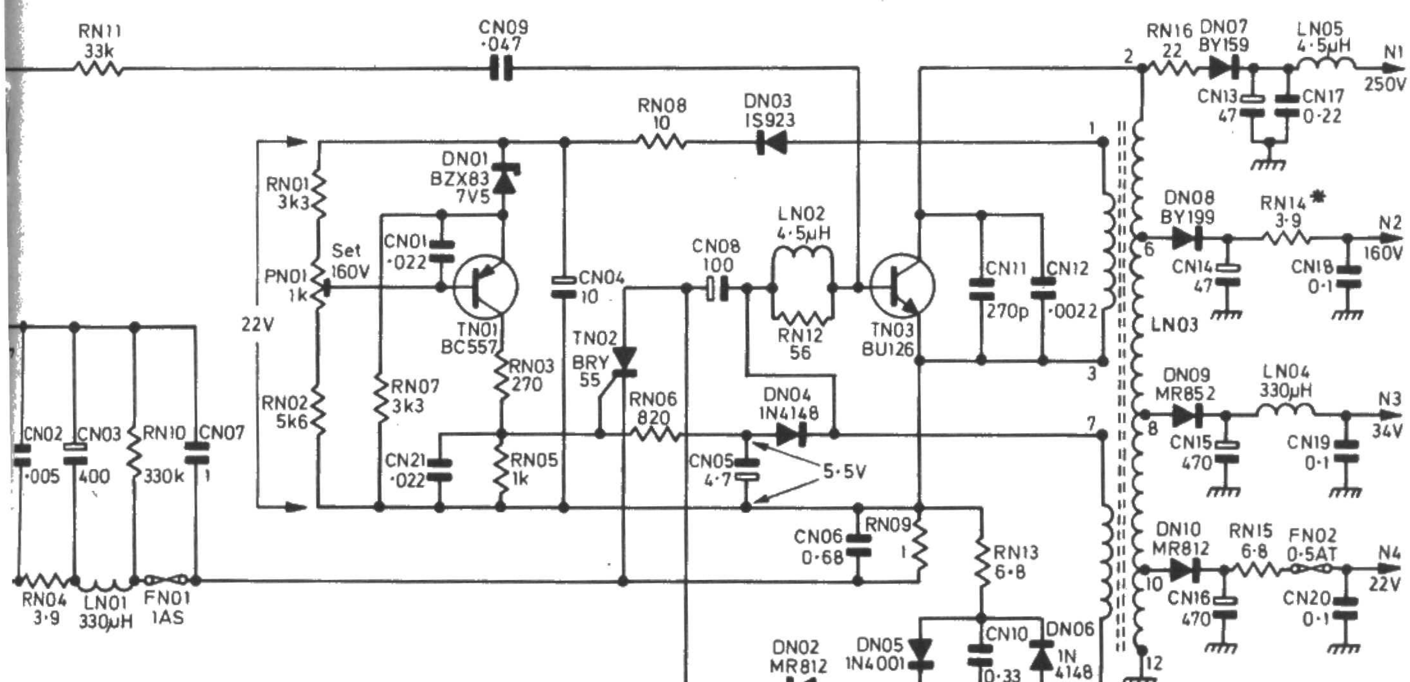
In later production CN21 was changed to an 0·047µF 250V type as the earlier component was sometimes the cause of intermittent operation of the power supply. Also a second 1N4148 diode, designated DN11, was added in series with DN06 to overcome the reluctance of some power supplies to start.

LT Supplies

The 34V N3 output feeds a 24V regulator on PCB1 (see Fig. 2). There is also a 12V regulator which on some sets is fed from the common N3 point and on others is fed from the 24V regulator (after DX05). These two i.c. regulators share a common heatsink, the 12V regulator being insulated by means of a mica washer. The 24V supply is used by the decoder module, the field timebase module and the convergence module – the latter two modules are also fed with a 40V supply from the line output stage.

The 24V regulator's output can go low, more often than not very intermittently. As well as affecting the performance of the modules it supplies, it also brings the trip circuit into operation. Violent break up of the picture is the most noticeable effect, but the fault is random and unpredictable – it can occur at switch on from cold, the trip operating, but after switching the set off and on again it may work for the rest of the day without the fault recurring. It's as well to replace DX05 whenever IX01 is replaced.

The 12V regulator supplies the i.f. and tuner circuits. It rarely gives any problems.



h-mode power supply circuits.

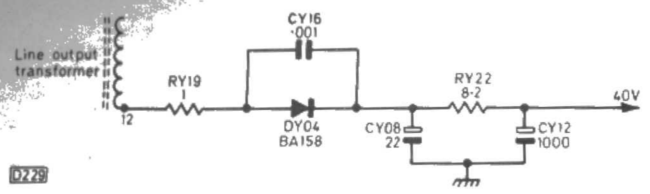


Fig. 3: The 40V supply is obtained from the pulse winding on the line output transformer.

The tube's heater voltage is obtained from a winding on the line output transformer.

The previously mentioned 40V supply (see Fig. 3) is used by the field output stage and the convergence panel. When DY04 goes short-circuit RY19 and RY22 burn up and the symptom is field collapse. These components are on PCB2.

Electronic Trip

The electronic trip circuit (see Fig. 4) provides comprehensive protection. It's at the lower end of PCB2. Transistors TY02 and TY03 are normally on. If the 160V rail goes high however TY02 switches off. TY01 then switches on, the positive voltage at its collector firing thyristor DY01. As a result, the 160V rail is shorted via LY01, DY02 and DY01. Under these conditions the chopper transistor will be receiving start-up pulses from DQ08, and as a result the 250V rail will be kept at some 15V. The conduction of DY01 is thus maintained until RN14 goes open-circuit, removing the 160V supply.

If the beam current is excessive, the voltage across RY20 rises (negatively) and TY03 switches off. Once again, TY02 switches off and TY01 switches on, firing DY01.

If the 24V supply is low, TY01 will conduct, once more firing DY01 to short-circuit the 160V supply.

Before the trip circuit is adjusted, the 160V rail must be set correctly. Then connect a voltmeter between the base of TY01 and the base of TY02. Adjust PY01 for a reading of 1V. A test for correct operation is to short-circuit the base of TY03 to chassis: the set should then switch off. Switch

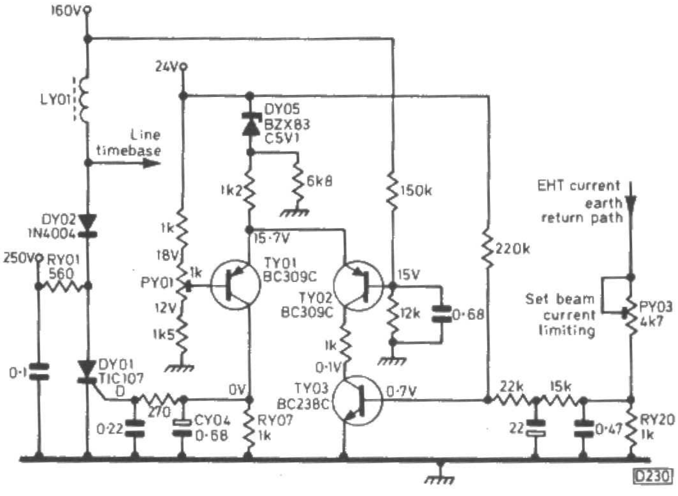


Fig. 4: The electronic trip circuit.

off at the mains switch, remove the short-circuit and then switch the set on again: the set should come on and work normally.

If you suspect the trip circuit, remove the thyristor and check it. With the exception of CY04, the other components can be tested in circuit. ■

Editorial Note

In the next month box last month we referred to Skantic sets fitted with the 20AX tube. Some sets fitted with this type of tube use the same basic switch-mode power supply module covered in this article, e.g. Models 6661, 6662 and 6663. The main difference is that in these sets the N4 rail is at 34V, both DN09 and DN10 being fed from tag 8 on the chopper transformer: line N3 also feeds the field timebase panel, via RY22 (1·2Ω) on the line timebase panel.

A self-oscillating chopper circuit is also used in earlier and later Skantic/Luxor solid-state colour sets, but there are numerous circuit differences.

A First Production

Eileen Bolton and Malcolm Burrell

My interest in trying my hand at programme production started when I obtained several hundredweight of equipment from the British Amateur TV Club and renovated it. In my mind were dreams of monitor banks everywhere, but in reality what I had were two ancient and very large 21in. beasts that had lived in Rediffusion's Studio 5 until the advent of LWT and colour had rendered them homeless. A vision mixer never materialised either: the two ex-studio Marconi cameras I had, fitted with enormous lens turrets, were switched by simply unplugging one and plugging in the other. An old, heavy duty cine camera tripod took root in the floor under the weight of one of these cameras, whilst the air shimmered in the heat from the glowing stabilisers in the power supplies.

Being an enthusiastic TV amateur during the early seventies, I was inclined to keep switching everything on and trying to produce programmes, whilst trying not to be too preoccupied with the technicalities and using the limited finances available to get better pictures. Then rumours of a true home video cassette system from Philips began to circulate, and increased responsibilities led to the disposal of most of my equipment. Dreams of creating a good programme, however short, continued however.

The opportunity to try again eventually arose with the chance to borrow a Hitachi VCR for a couple of days. Time to start all over again. A couple of decaying surveillance cameras were dusted off and tried out – for a lively production, two cameras at differing angles are needed, preferably securely mounted on tripods. We fortunately knew how to synchronise two or more picture sources to get clean cuts and mixes, and set about designing and building a simple monochrome system. Once this was ready it was time for the tryout.

Making a Start

The first golden rule of TV soon emerged – to be aware of one's own limitations and those of the equipment, without being unimaginative. The production was to be in monochrome, and the sets had to be simple to make and uncomplicated. So it was decided to make the theme of the story outer space. The lack of colour would then not be too

noticeable, while light figures against dark backgrounds would give dramatic pictures.

We'd no script to start with, but it seemed sensible to use a combination of models and live action, the story alternating between a space control centre and a space ship that has some task to perform. To introduce an element of excitement, we'll assume that the space ship is suffering from some sort of technical malfunction.

As a first attempt, we used chicken wire covered with newspaper shaped to form the interior wall of our space ship. An old monitor engulfed in cardboard was to be the centre piece of the control panel. This turned out to be very disappointing. Although it was almost eight feet in length and filled the shed, it looked hopelessly flat on the screen. In despair we tore this down and deposited it at the nearest rubbish dump. It was back to the drawing board therefore.

A Photogenic Action Man

An Action Man in a space suit and labelled Space Ranger was tried out with the equipment and proved to be quite photogenic. Now for some scenery. Some cardboard and a set of practice golf balls gave us a "space station". The rocket motors from a broken construction kit were then fitted to half a plastic shampoo bottle with a paper cone at the other end. We'd now a space shuttle craft as well. Both items were painted white and tested on the TV screen against a black backcloth. A crude control panel was then fashioned from various futuristic looking cutouts mounted on a cardboard wall. The wall was at first a light colour, but better contrast was obtained when it was painted black.

Equipment

It was becoming obvious that with several different models in use it would be necessary to have frequent stops to alter camera positions and change the scenery around in order to get a continuous action programme. A machine that had a pause facility without producing too great a disturbance on the screen when the tape was replayed was needed therefore. So a Ferguson 3V22 VCR was rented. Additional lights in the form of 150W bulbs mounted on hardboard offcuts were carefully positioned, and the workbench came to look like a toy theatre.

Dry print transfers enabled us to make neat titles on white cartridge paper, and a rough script was produced, outlining the visual action and dialogue (to be dubbed in subsequently). A sequence of thirty different shots gave us a five minute programme. Despite the apparent limitations of the budget Thorn VCR, it just had to be possible to produce some sort of programme.

Story Line

The story line was simple. Astronaut Jeff Ackland is on a space patrol from Space Station Elida 7. Computers indicate that an asteroid threatens to destroy the station, and Jeff is instructed to intercept it. The shuttle develops a fault and becomes unstable however. Jeff leaves the craft to repair the damage, but it seems too late to take action against the asteroid. "You're too late Jeff" cries the controller. "We're doomed – save yourself by returning to Earth." Jeff manages to crash his craft into the Asteroid however, destroying it.

Titles

It took six attempts to produce the titles. The mixer was set at black level whilst the cameras were aimed at different title cards in turn. Start VCR, let it run for a few seconds, then fade up from black on camera 1: hold for a few seconds, then dissolve to camera 2. Subsequently fade to black and select pause on the VCR. Somehow it seemed that the wrong buttons would get pushed, or else a fade was done too quickly. Eventually the titles were done however.

Shooting the Story

Things were then rearranged, the VCR was started and we faded up on camera 1, which was focused on a picture of the Milky Way. Then over to camera 2, which pointed at the space station, rotating jerkily as it went round on an old gramophone turntable. Taking a chance, we pushed the pause button without fading down. Rearrange cameras, with one looking at a picture of a corridor, the door at the end being marked "control", and the other situated at the back with a couple of aged monitors arranged to flicker in a suitable technical fashion. The VCR was restarted and the scene set.

A cause of great amusement was the "asteroid", which had to appear in a couple of cutaway shots. It consisted of a small chunk of polystyrene, mounted on a wire and moved against a black background with stars. A shot of the space station in motion was obtained by mounting it on a wire, placing the camera above it, and moving the background beneath. Another shot required it to be moved across the screen against a stationary background. Not as easy as it seems, as one watches a monitor over one's shoulder.

Special Effects

Some technical drama was achieved with cutaways to an oscilloscope displaying a sinewave pattern that increased in size as the asteroid moved closer. This made an effective closing shot immediately after Jeff's destruction of his space craft and the asteroid, with the single spot moving slowly across the screen. Without resorting to lots of smoke and bangs everywhere, the destruction was faked by suddenly increasing the target bias on the camera concerned, so that the screen turned white: quickly taking away the space craft and asteroid left the original background of stars when the camera was restored to normal.

Adding the Sound

With the Thorn 3V22 it's possible to dub in the sound directly, using a high-impedance microphone. A cheap but effective one was purchased for about £9. The use of music was ruled out because of the obvious copyright problems. Instead, hiss and faint, distorted voices were recorded from a radio on the short waveband. This provided a suitable sound effect: there's no sound in space, but we'd got the atmosphere we wanted. For the space ship's engines we used a vacuum cleaner, recorded at varying distances to suit either interior or exterior shots of the craft. The roar of the explosion that destroyed the asteroid and space craft was obtained by blowing into the microphone.

Conclusion

Our little production proved to us how much we take for granted. Even for our five-minute space drama, a lot of time, patience and stamina were required. It would be all too easy to get despondent and give up when things don't go right.

So, if you've some ideas and access to even just a simple camera and VCR, do give it a try. It can be fun. ■

The Flying Scotsman

Les Lawry-Johns

ABOUT a month ago we sold a Fidelity colour portable (Model CTV14R) to one of our regular customers who frequents our local pub. This means that we see him pretty regularly. He was delighted with his new colour portable, being able to lay in bed with the remote control unit and thus able to switch the set off without getting up as his eyes grew heavy. The other day he popped in to say that it had developed a mind of its own however. Just as he got interested in an ITV programme, the set would change to BBC-1 and wouldn't go to any other setting no matter how many times he pressed the channel change button.

"Bring it in Jock" we advised him. "We have ways of making them change their minds."

Jock McStrap is a fast mover, and while I was pondering on the possibilities he had gone and come back again. He plonked the set on the counter and launched into his theory.

"Say I've got it on channel 3, like this. It'll be all right for some time, then the channel 1 indicator will start to glow and get brighter and then clonk, it changes to 1 and the channel 3 light goes out." Without a pause he continued "I think it's a little something touching where it shouldn't when it gets warm you see ... Whatever it is, it won't take you a minute to find so I'll call back later."

"O.k. Jock, we'll do our best to make it behave itself."

So off went Mr. McStrap, leaving us to consider the situation and decide on a course of action. He hadn't brought the remote control unit with him, so we watched for the fault to develop and it did. As a matter of fact the channel 1 LED (see Fig. 1) glowed faintly from switch on, even though another channel had been selected and the appropriate LED lit up fully. Within a short time the channel 1 indicator got brighter and the set switched to channel 1, just as Jock said it did. Like a flash I reached a decision – which turned out to be the wrong one of course. "It must be a faulty chip – the ML232B channel selector" I thought.

Bearing in mind what sort of a device it is, I took all the usual precautions, earthing everything to make sure that no static charges could ruin the new chip. We then set about removing the front control panel where the chip lives. After a bit of swearing and cussing at everything and everybody, the new chip was installed and we were ready for testing. The channel 1 LED still glowed faintly when another channel was selected, so we knew we'd dropped yet another clanger.

I then did what I should have done in the first place and studied the circuit. Transistor TR3 is linked to the channel 1 indicator, and it seemed likely that if slightly leaky it could be responsible for the symptoms. A new BC157 was fitted and proved to be the answer – to the defective channel change that is. (Note that the provisional circuit shows the type incorrectly as BC548, which is an npn device: the full manual gives the correct pnp type, BC157 or BC557.) Having refitted the panel and wrapped the set up we felt satisfied that the job was done. Jock came back and satisfied himself that the channels changed as they should do.

"Was it a wee something touching, Lawry?"

"Leaking, Jock. It was a wee leak after all."

So off went Jock, only to return next day.

"It's doing it again Lawry, but it's now worse. It won't even stay on channel 1."

My heart sank. What now?

Investigation proved that over a period all signals were lost and that the tuning voltage to the tuner fell to zero intermittently. The supply to the TAA550 30V stabiliser on the front panel remained steady, and seemed to be present at the ML232B i.c., though it was difficult to tell because the fault was coming and going rapidly. Like the fool I am I again accused the chip, and went through the rigmarole of changing it – only to find that the fault was still present. I then found that movement of the panel prompted or cleared the fault, suggesting that we had either a poor connection or perhaps a crack somewhere. I eventually found the crack – through three tracks – though it was almost too fine to see. It had apparently occurred when I'd refitted the panel on the first occasion and had difficulty aligning it with the fixing holes. Having repaired the panel we put the set on a prolonged soak test and experienced no further trouble.

We've sold dozens of these nice little sets, and this was

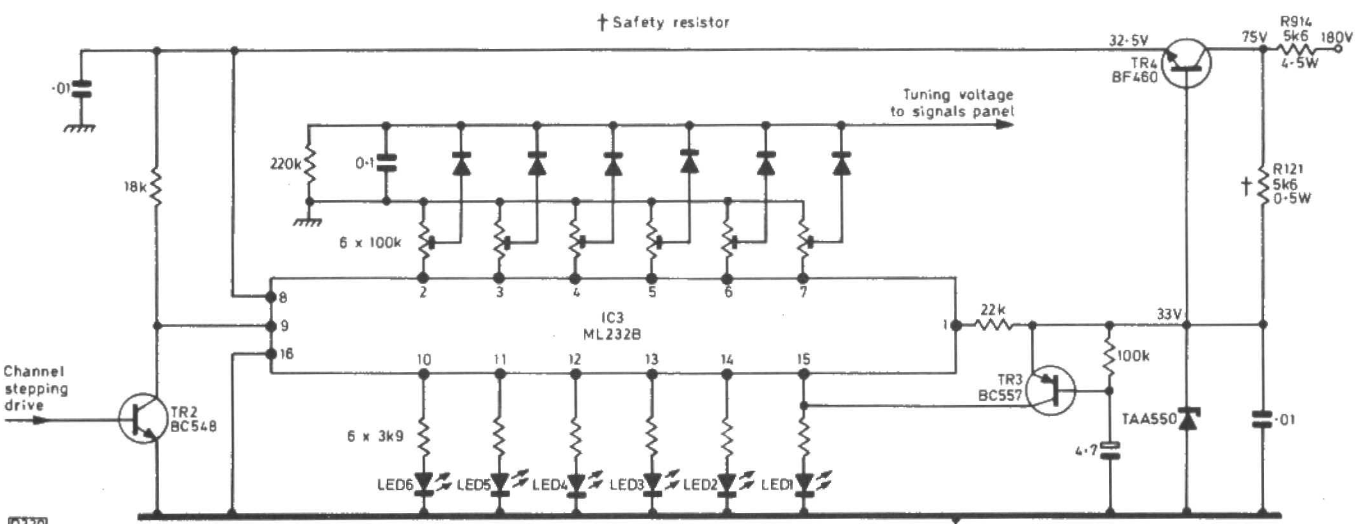


Fig. 1: Channel selection circuit, Fidelity Model CTV14R.

the first bit of trouble we've had, so we mustn't complain. Jock seemed happy enough anyway, and his friend Chip Fryer has come in to buy one as a present for his wife. All quiet on that front.

The Waltham W125

I'd sold this 24in. Waltham monochrome set some five years ago to an elderly lady who'd brought it back and made me an offer I couldn't refuse: if she had it back before evening, I could live. This precluded sending off for spares, and it was an unfortunate fact that the e.h.t. overwinding on the line output transformer was running warm even with the stick rectifier disconnected. The spark at the overwinding output was less intense than the one at the top cap of the PL504 line output valve, so whether I liked it or not the transformer was faulty and my time was running out.

I searched through my stock of transformers, but I knew I didn't have one. The only alternative was to remove the faulty winding and fit a tripler, or to strip down the transformer and fit another overwinding. Being a lazy cove I chose to cut away the faulty winding and fit a tripler – using one of the Thorn five-stick replacements with a short connection to the PL504 anode connection point on the transformer (with a PP3 battery stud to fit to the tripler). As expected, the resultant picture was lacking in width: the correct tuning capacitor turned out to be a 35pF 8kV working disc type, from the anode connection to chassis. This low value was in fact a surprise, as I'd expected to use a value more like 100pF – but the width was then excessive.

So we made the tripler secure and checked the rest of the set before returning it to the old dear. It was late afternoon and already dark when I arrived at her house. The full moon shone brightly in the clear sky, and an aircraft had left a vapour trail that seemed to skirt around it. "Oh look" said the old girl, "if he hadn't seen it in time he'd have flown straight into it." Honest.

Late Night Final

I arrived back at the shop expecting it to be closed. The lights were on however and there was a car outside. A lady had brought in a large, 26in. ITT set (FT110 chassis) with the help of her son and daughter. We'd last repaired it about a year ago, when her husband had brought it in. This time he had elected to stay at home watching the portable rather than risk having to listen to me moaning about the difficulty of diagnosing the cause of the trip circuit tripping. And tripping it was. Not the full-bodied hrrrump-bonk some sets produce, but more a sort of soft tick tick.

I disconnected the tripler as a start. That didn't make any difference, so I set off on a wild goose chase trying to find a shorted diode. "Perhaps it's the transformer" said Honey Bunch helpfully, thinking of the long line of transformer failures we've had of late. This jolted me into thinking a little more rationally: I hadn't checked the line output transistor, which turned out to be dead short collector-to-emitter. We removed the BU208 with some difficulty, and with much cussing and blinding about accessibility fitted a new one together with two new 0·005µF (to make up 0·01µF) pulse type flyback tuning capacitors just in case.

Knowing my luck when performing before an audience, I switched on with fingers, legs and eyes crossed. It worked, and worked well enough apart from a little misconvergence on the left-hand side. This seems to be a common feature of these sets however, and by this time it was getting late and the family were only to pleased to cart the set off back to dad.

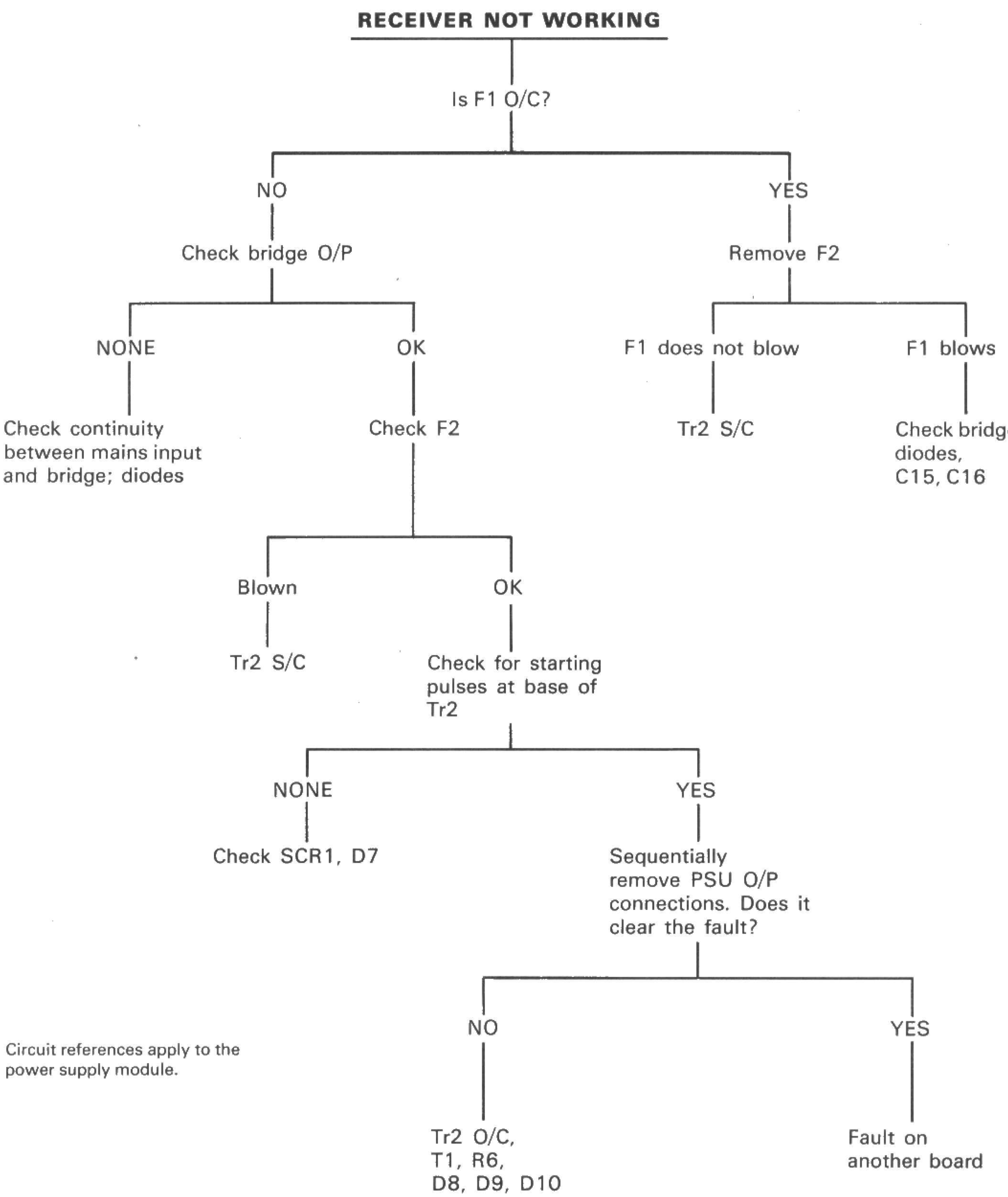
Colour Portable Project

Part 8

Luke Theodossiou

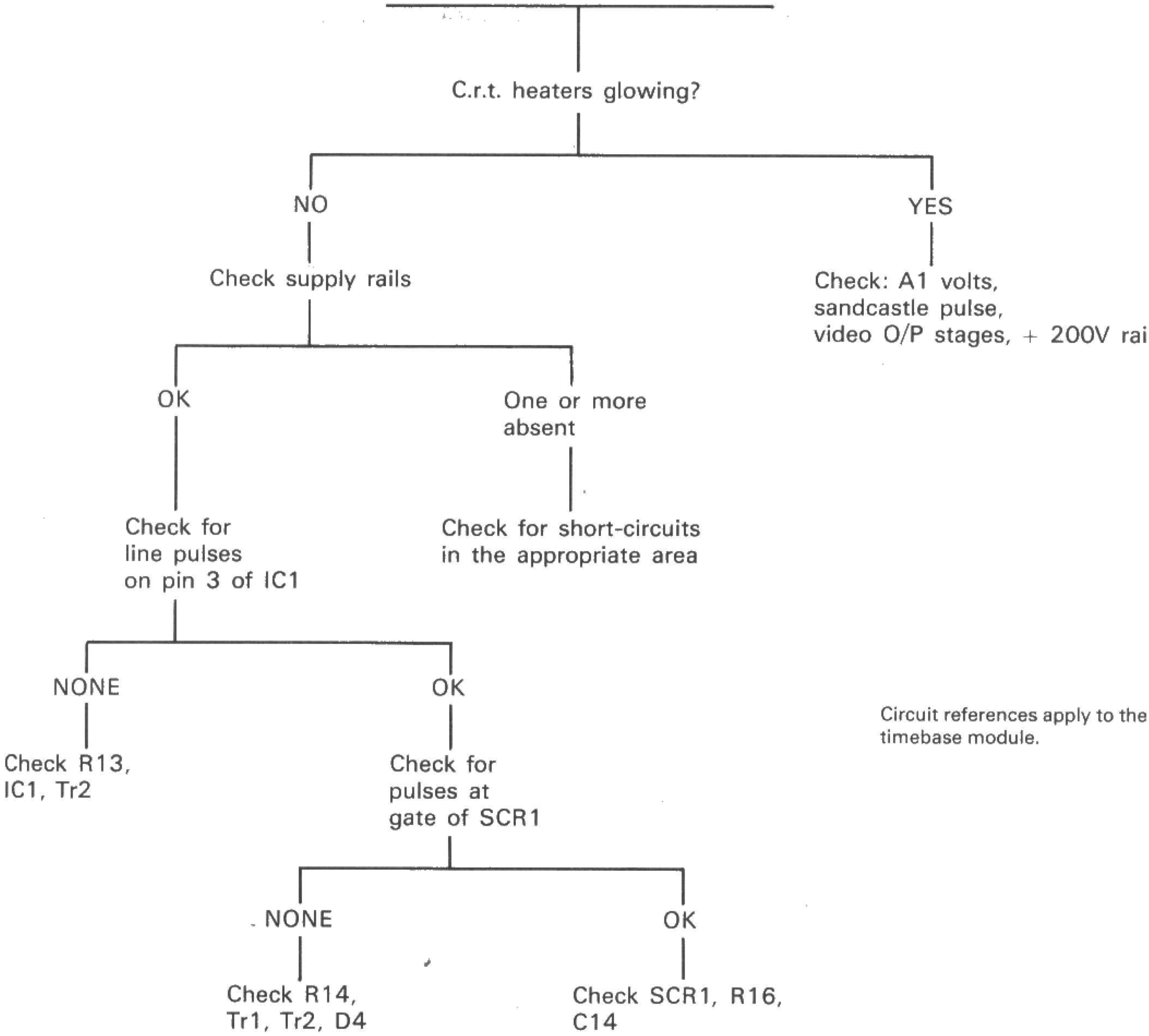
In this final instalment in the series, we shall describe the setting-up of the complete receiver and also give some guidelines to fault finding.

We assume of course that each board has been visually checked against the component overlay diagram, and that all interconnections have been made and checked. On switch-on the healthy sound of the e.h.t. building up should be heard. If not, switch off, check everything thoroughly



Circuit references apply to the power supply module.

SOUND, NO RASTER (PSU OK)



and then consult the fault finding charts. If all is well, make the following adjustments:

E.h.t.: Connect a scope to the anode of SCR1 on the timebase board and adjust VR1 on the power supply board for 1200V pk-pk pulses at black level (i.e. with the contrast and brightness controls at minimum).

Line hold: Ground pin 6 of IC1 on the timebase board with a wire link. Adjust VR2 on this board for a floating but resolved picture. Remove the link.

Picture size: Adjust L2 and VR5 on the timebase board in conjunction with the linearity controls L1 and VR4 for a correctly proportioned test card display.

Picture shift: Adjust VR1 (line) and VR6 (field) on the timebase board to centre the picture.

Focus: Adjust the focus control on the line output transformer for optimum overall resolution whilst displaying a test card at nominal brightness and contrast settings.

Grey-scale:
1. Turn the brightness, colour and contrast controls to minimum, and adjust the background control VR3 on the timebase board for beam cut-off.
2. Set the black-level controls VR5, VR6 and VR7 (signals board) to their mid point and the drive controls VR2, VR3 and VR4 clockwise (i.e. with their wipers towards the 2k2 resistors R16, R17 and R18).
3. Connect an AVO 8 or similar to each of the video outputs (Connector C). Adjust VR5, VR6 and VR7 for 160V at each output.
4. Adjust the background control until one of the guns just begins to light the screen. Leave the background control in this position and adjust the black-level controls of the other two guns until they too just light the screen by the same amount.
5. Turn up the brightness and contrast controls for a

normal display and trim only one or two of the gain controls to equalize the highlights.

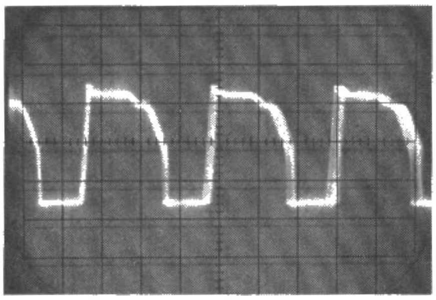
Chroma filter and chroma trap: Connect a scope across C4 on the signals board and adjust L2 for maximum amplitude of the colour burst. Transfer the scope probe to R3 and adjust L1 for minimum colour burst amplitude.

Reference oscillator: Turn the colour control to maximum and short-circuit pins 23 and 24 of IC3 on signals board. Adjust C12 until the right colours are just running through. Remove shorting link.

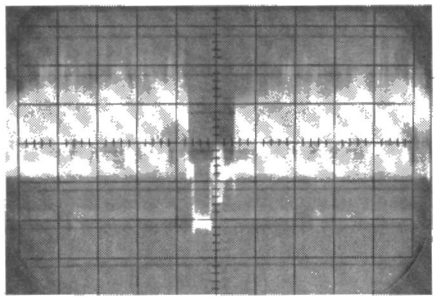
Delay line Phase and Balance: Display standard colour bars. Connect a scope to pin 21 of IC3. Adjust VR1 on signals board for minimum amplitude of the red and cyan bars. Transfer scope probe to pin 16 of IC3. Adjust the coil nearest to pin 6 of the SDL445 chroma delay line for equal amplitude on sequential lines. This tends to look like a jittery vertical movement and the objective is to reduce it to a minimum. It is worthwhile repeating the procedure to ensure the absence of Hanover bars.

The setting up procedure is really quite straight forward, and looks worse on paper than it actually is. Do not attempt to adjust the i.f. module or the tuner – these are prealigned by the manufacturers. ■

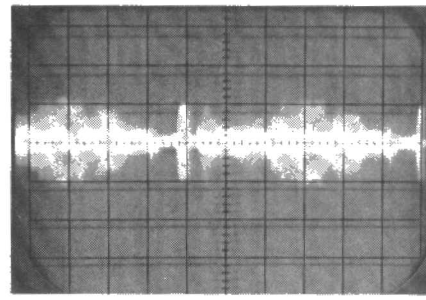
CHECK WAVEFORMS



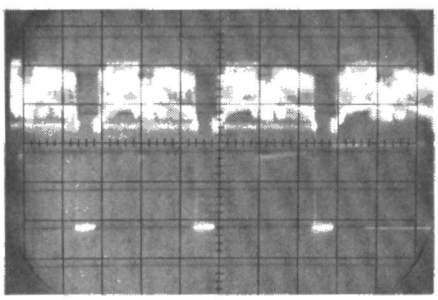
1: *Collector of Tr2, power supply board. 600V peak-to-peak.*



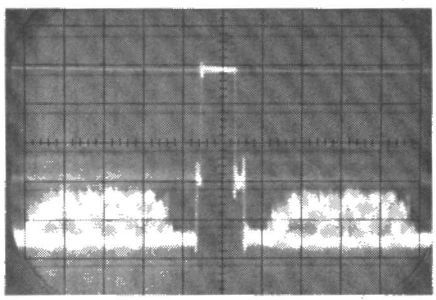
2: *Pin 6 of the i.f. module, signals board. 1V peak-to-peak.*



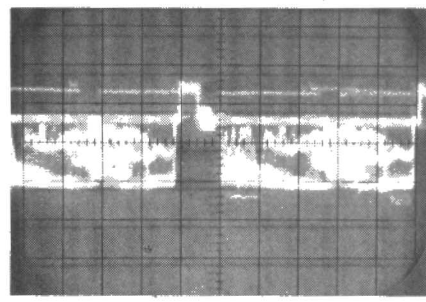
3: *Pin 3 of IC3, signals board. 0.2V peak-to-peak.*



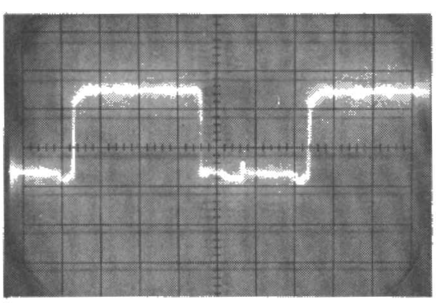
4: *Pin 12 of IC3, signals board. 8V peak-to-peak.*



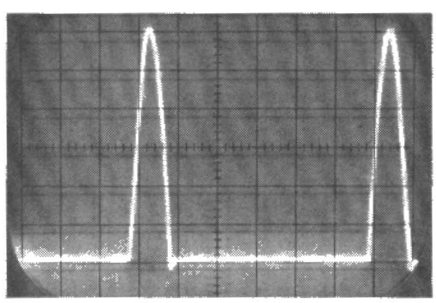
5: *Connector C3, signals board. 100V peak-to-peak.*



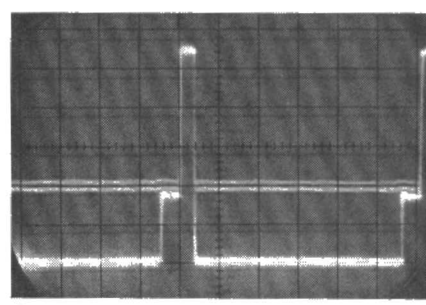
6: *Connector A2, timebase board. 3V peak-to-peak.*



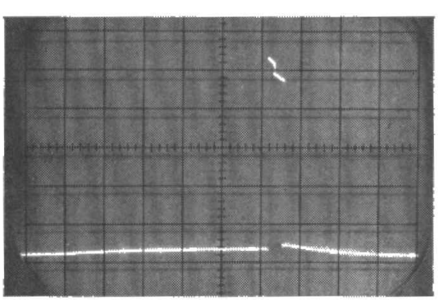
7: *Emitter of Tr1, timebase board. 13V peak-to-peak.*



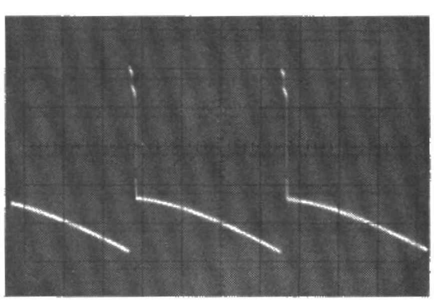
8: *Anode of SCR1, timebase board. 1.2kV peak-to-peak.*



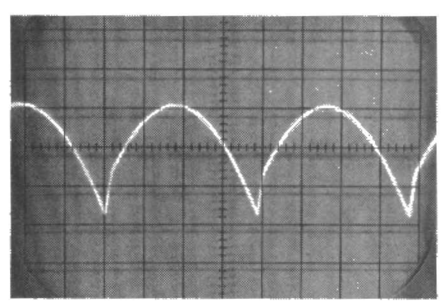
9: *Connector A3, timebase board. 11V peak-to-peak.*



10: *Pin 3 of IC2, timebase board. 24V peak-to-peak.*



11: *Connector D2, timebase board. 48V peak-to-peak.*



12: *Connector D1, timebase board. 3V peak-to-peak.*

Letters

TUBE FAULTS

The following list of common tube problems and cures will I hope prove useful to your readers.

Flashovers: Check the resistor which earths the c.r.t. Rimband – it often goes high in value. Check the Aquadag earthing straps for corrosion – this will result in a poor earth path. Check the e.h.t., which could be high. The e.h.t. *must* be checked at black level. It's common to find that the h.t. is correct and the e.h.t. too high, and very common to find that e.h.t. meters give low readings. Also check the heater voltage. We sometimes find that an old heater boost transformer has been left in circuit. Heater voltages obtained from the line output transformer are suspect as they cannot be measured with normal meters. Fitting a separate heater transformer often provides a cure.

Short c.r.t. life: Heater voltage problems – see above. Incorrect tube drive. The first anode and drive controls should always be set up correctly after replacing a worn tube. The picture may look good even though the drives are incorrectly set, but the tube life will be short. Check for faulty components as necessary. Also check the beam limiter circuit – the maximum beam current should not exceed 450μA per gun.

Purity problems: Where problems are experienced, check the set's degaussing circuit and carry out manual degaussing. The use of a "suspect" external degaussing coil can damage a tube.

Tips: To lessen the risk of damage when starting up an "unknown" set, disconnect the cathode leads from the c.r.t. Connect the three cathodes together and take them to chassis via a 4·7MΩ resistor. This will produce a blank raster, allowing adjustments to be made. This can also be tried if a tube keeps flashing over after the checks listed above have been carried out – running for a few hours in this condition will cure most tubes, though the correct thing to do is to return the tube to the maker/rebuilder, reporting the fault.

Rebuilt tubes should be purchased from companies with the confidence to give a two year guarantee and the option to extend this to four years.

P. Watmough,
Chief Engineer, Trent Tubes,
31a Radcliffe Road, West Bridgford, Notts.

SIMPLE CAPACITOR TESTER

I was very interested in Victor Rizzo's letter (March 1981) describing his simple capacitor tester. One point needs correction – the diode type specified. The 1N4002 has a p.i.v. rating of only 100V, and the circuit voltages exceed this. All will be well with a 1N4004. To reduce the test voltage in the version I built I decided to add a resistor across the reservoir capacitor. A value of 470kΩ ($\frac{1}{2}$W) gives a voltage of 100V across the probes, making the tester safer to handle and allowing capacitors with voltage ratings down to 100V to be tested. There's less voltage across the neon of course, so it may be necessary to reduce the value of its series resistor. My tester works perfectly well with a 270kΩ resistor as originally specified however. Note that capacitors being tested must not be connected to earth – for example a capacitor in an earthed radio receiver.

W. Spencer,
Brisbane, Australia.

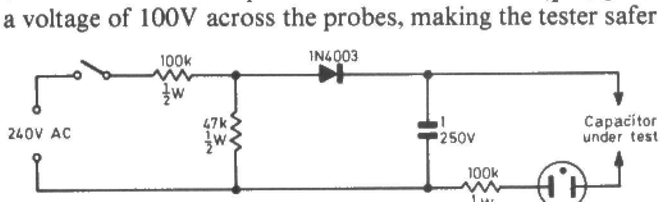


Fig. 1: Suggested simple capacitor tester circuit.

Editorial note: An alternative approach would be to feed the rectifier from an a.c. potential divider. This will reduce the voltage rating required for the reservoir capacitor and the diode's p.i.v. rating. We suggest that readers interested in the idea try the circuit shown in Fig. 1. As Victor Rizzo originally stated, no suggestion of a flicker when a capacitor is tested indicates that it's open-circuit, a continuing glow indicates a short-circuit, and continuing flickers a leak: a good capacitor will light the neon momentarily, the glow obtained depending on the capacitor's value.

PHILIPS K12 CHASSIS

There was a production slip in my article on the Philips K12 chassis last month. A short-circuit line output transistor (or D551) will activate the overload trip. When the chopper transistor goes short-circuit the symptom is a dead set (no overload because there's no drive from the chopper transformer to the line output transistor, and some 300V at test point M2).

Derek Snelling,
Brownhills, Staffs.

LOPT PROBLEM

A Philips G6 (single-standard version) was brought to us for convergence adjustment and crackling sound. These problems were dealt with and the set left on soak test. An hour later the mains fuse blew. There were no shorts, so a new fuse was fitted. Two hours later the raster went, leaving sound only. This time the fusible resistor R1073/FS1115 in the h.t. feed to the line output stage had sprung open. There were no shorts here, so I resoldered the resistor and switched on to see the result. The PL509 line output valve was glowing red hot and within a minute R1073 had opened again. Now this presents a bit of a problem – how to carry out checks when you've only a minute to do so? Disconnecting the line output valve's screen grid feed resistor R5030 calmed things down and I was able to check that line drive was present. So the line output stage was being overloaded. A considerable time was spent checking various components, including the d.c. feed choke, and I eventually found that when the line output transformer was disconnected from the line output valve a reasonable spark could be obtained from the top cap. It seemed reasonable to assume that the line output transformer was at fault, and on fitting a replacement everything came up with flying colours.

I was thankful to get the set working again, but felt it necessary to bear some of the expense since the fault was not what my friend had originally complained about.

Kanak Babla,
Lichfield, Staffs.

Editorial note: An awkward situation, agreed, but the line output transformer could have failed at any time and was not your responsibility. In fact the line output transformer is suspect on these sets, which are now well over ten years old.

Practical TV Servicing: Triplers and their Habits

S. Simon

IN a recent article in this series we stated that loss of focus is often due to the e.h.t. tripler. Whilst this is so, we hope we didn't give the impression that this is its only crime. Indeed this is one of its most minor indiscretions. Despite the elaborate safety circuits incorporated in most modern TV chassis, the e.h.t. tripler is still responsible for the most expensive TV repair bills (apart from the need to replace the c.r.t. of course), because of its habit of inflicting mortal damage upon the line output transformer at the moment of its demise.

The term tripler tends to be used fairly loosely to describe e.h.t. units employing a string of rectifier diodes and capacitors to step up the pulse voltage provided by a winding on the line output transformer to the e.h.t. voltage required for the final anode of the c.r.t. The original objection to the idea of voltage multiplication in this way was that it didn't give very good voltage regulation. This objection has been overcome by using harmonic tuning to provide a flat-topped input pulse and other refinements, the net result being that until the advent of the diode-split line output transformer the transformer-plus-tripler arrangement was the norm for e.h.t. generation.

Whilst most of these e.h.t. units are indeed triplers, there are also doublers and quadruplers, the former being used mainly in certain monochrome sets and smaller-screen colour sets and the latter in a few early colour receivers. The tripler is also usually the source of the focus potential in a colour receiver, and often via the line output transformer provides a supply of some 1kV for the c.r.t.'s first anodes. Some triplers incorporate a clipper diode to remove the negative overswing from the input and some don't, so all in all these e.h.t. units come in a variety of forms. Our present purpose is to clear the air a bit on the subject and perhaps sort out one or two misconceptions.

Early Days

The first major TV setmaker to employ solid-state e.h.t. units was Thorn – in later versions of the 900 chassis, dating from 1965. The units were of the multi-stick type, each stick consisting of a selenium pencil rectifier: they were used in conjunction with the famed Thorn jelly-pot line output transformers. Most other setmakers continued to use a single valve e.h.t. rectifier in conjunction with a substantial overwinding on the line output transformer. Other manufacturers subsequently swung over to the use of an overwinding feeding a single stick rectifier – an example that springs to mind is the Indesit Model T24.

The habits of the solid-state units used in monochrome chassis such as the Thorn 1400 and 1500 series became well known to us before their advent in colour receivers – we became quite used to the terrible smell that issued from them when one of the sticks developed a high-resistance section, dropping a high voltage across it and thus becoming overheated and generally distressed. This obvious symptom was accompanied by the less obnoxious one of fine lines slipping across the screen when the brightness was turned up, and the picture swelling in size with a dark area in the centre. We used to refer to the faulty units as "e.h.t. trays", recognising that the larger-screen Thorn models called for a five-stick unit (tripler) while the smaller-screen models were fitted with a three-stick unit (doubler). We also came to recognise that a fully enclosed unit was less likely to break down than one of open construction, i.e. one in which the rectifiers and capacitors are visible to the eye.

Colour

The advent of colour brought with it a new generation of

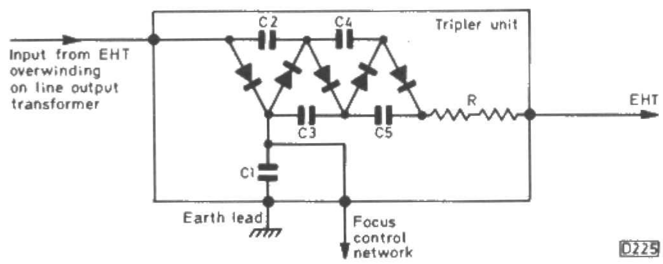


Fig. 1: Typical five-diode tripler arrangement. The voltage developed across the first capacitor C1 can be used to feed the focus control network. Resistance R is included to reduce flashover current surges – it may be incorporated in the anode cap lead rather than the tripler itself. Earlier triplers designed for use with valve line output stages usually omitted the surge limiting resistor and the final capacitor C5. C1 may be taken to a positive or negative supply to adjust the e.h.t. voltage. In some circuits a resistor (usually 470Ω, 1W) is included in series with C1 to provide surge current limiting. In some earlier types of tripler C1 is an external component. Most triplers use silicon diodes, but some earlier designs use selenium sticks.

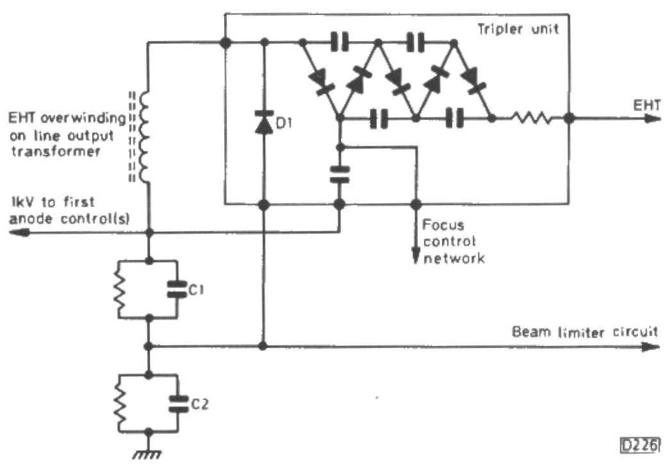


Fig. 2: Typical six-diode tripler – the additional diode (D1) at the input clips the negative-going overswing that follows the input pulse, improving the regulation and producing across C1 a voltage of about 1kV for the c.r.t. first anode controls. The voltage at the earthy end of the e.h.t. circuit can be used to operate a beam limiter circuit.

larger e.h.t. units better able to cope with the increased current demand, and initially these units appeared to be more reliable than their more flimsy cousins used in monochrome sets. It's one thing to produce 25kV however, another to be able to contain such a high voltage. The result was that insulation breakdown became more common. This in itself presented no problems once the family had been calmed down and assured that it wasn't a common event. A new unit could be speedily fitted with little or no complication. Internal breakdown, whilst less spectacular, can result in greater damage since the viewer doesn't have the same incentive to switch the set off once the picture goes. The heavy current that then flows can spell doom to the line output transformer – or the e.h.t. transformer in the case of chassis such as the Thorn 3000/3500 series.

Hot Trays

If you suspect a tripler, the obvious step to take is to disconnect it. Whilst with some units the input lead plugs on to the transformer, with others the connection is soldered. Once a defective unit has been rendered harmless in this way the transformer should come to life – provided it's in working order, being driven and the supply is still intact (no blown fuses). Quite often a faulty tripler will be warm, or possibly hot, in one part if left in circuit for a short time.

This is a sure indication that it is defective. This is not to suggest that all faulty triplers run hot however. Some do, some don't – it depends on the type of fault within the unit. Suffice it to say that if a previously dead transformer comes to life when the tripler is disconnected, i.e. a neon lights up when held near the transformer when previously it didn't, then there are grounds for suspecting that all is not well within the tripler and a new one should be obtained and fitted – having ensured that it is of the correct type.

Merely specifying say "a tripler for a GEC please" is a sure prescription for a baffling hour or so until it's realised that some models require a tripler with an extra connection and this is the one needed. As well as the more common "specials", it's a good idea to stock a few "universal" triplers for use in various models – these generally come with a sheet detailing the sets with which they can be used plus fitting instructions for different chassis.

The EHT Connector

All triplers/e.h.t. units have the high-voltage lead and tube anode cap permanently connected. No attempt should be made to repair the lead as the insulation must be of a high order. The only exception to this is when the e.h.t. cap has deteriorated at the tube anode and a new one needs to be fitted. If the original cap incorporates a series resistor, the same value resistor must be fitted in the new cap if this does not already incorporate one. Whilst it's permissible to redress the lead at this end, no large amount should be taken off as the length of the lead often determines the line output stage tuning and is fairly critical – especially in the case of screened leads.

Damaged Transformers

A faulty tripler can damage the transformer that drives it, and this is more likely in some sets than others. The overwinding on the transformer in the Rank T20 chassis for example seems to be rather fragile. If it fails, either a new transformer is required or a new overwinding can be fitted if one is prepared to go to the trouble of replacing it. Another transformer that's particularly susceptible to suffering at the hands of a nasty tripler is that used in the ITT CVC20-CVC30 series chassis. Even if the tripler doesn't appear to be at fault, there's a school of thought that the transformer should never be replaced in these chassis without a new tripler also being fitted.

This last comment doesn't apply in the case of the Philips G8 chassis, in which the transformer regularly fails with no help from the tripler at all – though there's always the possibility that the tripler could be defective. We've already mentioned the Thorn 3000/3500 series chassis, where the e.h.t. transformer (the one with the nipple on it) often fails as a result of a faulty tripler. If the tripler has been condemned as faulty and after disconnection the voltage across the 1·5Ω wirewound resistor R907 on the beam limiter panel is still excessive, i.e. well over 1·3V, the transformer is the major suspect.

VCR Clinic

Reports from Steve Beeching, T.Eng. (C.E.I.) and Mike Sarre

IF anyone had come up to me and said that the cause of a VCR failing to operate when under the control of the timer was an oily drive belt my reaction would have been one of deep suspicion. As per usual however I do get 'em! The story goes something like this.

In comes a fellow dealer with a Toshiba V8600 VCR. It works on all functions except when left to do a timed recording. More often than not, at the point when it's supposed to start the timed recording it goes clunk a couple of times and stops.

To start with some time was spent, naturally enough, on checking the "timer on" signals. Between "power on" and "timer record start", there's a 700msec delay whilst the tuning circuits are reset to channel one and then counted up to whichever channel has been selected. Everything in this area was fine, and gave no indication of intermittent failure – not that circuits ever do.

The technique to adopt with intermittent problems is to find a way of persuading the circuit or system to misfunction at your command. In this case I found that if I held the play button in and switched the machine from standby to on, then releasing the play button, I could persuade the machine to go clunk and stop: the point here is that in the timer mode the start signal is present when power on comes on, but the system was not latching to record/play during this period for some strange reason.

Further investigation brought us to the tape slack sensor. In the manual play or record mode the sensor stayed put since the tape tension was maintained. In the timer start mode or with me messing it about however the tape went slack for a brief moment – enough to allow the slack sensor to operate and shut the machine down. To prove this, the tape slack sensor was shifted to a position where it couldn't interfere. This confirmed the diagnosis, but of course nothing is simple and the tape shouldn't go slack at the point of timer start. Remember however that power had only just been applied: the take up spool was not quick enough to take up the slack, due as I said to oil on the drive belt. **S.B.**

PQS Fault

Here's another V8600 saga (let's face it, this is not Toshiba's month). The problem was that the machine intermittently failed to stop during rewind when PQS (picture quick search) was being used, though it worked perfectly every time in fast forward.

Let's take a look at the operation of the circuit (see Fig. 1), which is simple enough. During normal operation a

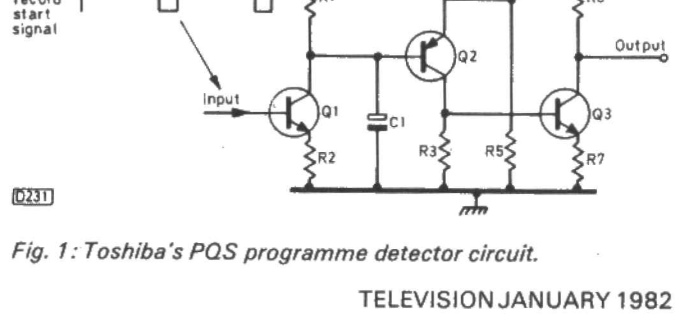


Fig. 1: Toshiba's PQS programme detector circuit.

signal with a 50:50 mark-space ratio is recorded on the control track, i.e. a symmetrical squarewave. Whenever the machine is first switched to record however the waveform's duty cycle changes to 20:80. This change lasts for only ten seconds, the control track signal then reverting to 50:50. When PQS is used, on fast forward or rewind, a circuit detects the change in the control track signal, i.e. the start of each recording is detected. In fast forward or rewind, capacitor C1 charges to the positive rail voltage via R1. Thus Q2 and Q3 are both cut off and the output is high. With the normal 50:50 control track signal input C1 retains its charge, but when the signal changes to 20:80 Q1 turns on long enough for C1 to discharge sufficiently for the voltage at the base of Q2 to fall below the voltage at its emitter (set by R4/R5). Thus Q2 and Q3 turn on and the output goes low. With the exception of the capacitor, this circuit is all contained within an i.c.

As the machine belonged to one of our customers, Andy was despatched with a test tape that contained a lot of record starts. His report was the first of many steps that led to a rather complicated revelation which cost me money to sort out for Toshiba: when our tape was used instead of the customer's, the recorder would not stop during PQS in either direction! The machine was brought into the workshop therefore.

A whole afternoon was spent with two V8600s on the bench – the customer's machine and the one on which we'd made the test recording. To cut a long story shortish, we eventually discovered that the PQS record start signal on our test tape was upside down when replayed on the customer's machine, though it was normal when replayed on the other machine. A test tape made with the customer's machine produced normal results when that machine was used in the fast forward mode, but in the rewind mode the machine sometimes failed to stop. When this tape was used in our test machine it wouldn't work at all. You can imagine the despair that was building up . . .

Anyway, I know you'll want to hear what the problem or rather problems, were. First the customer's machine, which didn't always stop in rewind. Well, tolerances played a major part in this. C1 is 1μF, and the high tape speed meant that the capacitor was not discharging sufficiently below the voltage set by R4/R5. So I made a little modification, changing C1 (it's actually C613) to 0·47μF. I imagine that there could well be lots of "oh, so that's its".

Now to the test machine – why was the PQS waveform upside down? Well, the connections to the control track head were reversed. But wait – before you go rushing off to change any over, the wires to the audio head seen from its rear are white-red, reading from left to right: the leads to the control track section of the head below should also read white-red, but on our test machine they read red-white. If you simply swap them over however you'll not get the same tracking range when replaying prerecorded tapes as when replaying the machine's own tapes – or the customer will have difficulty playing prerecorded tapes. When the machines were made you see, the reversal of the leads to the control track head was compensated in aligning the head, i.e. the tracking error due to the reversal of the leads was compensated for by the adjustment of the head's position during manufacture. Only the PQS operation is really affected by this: I wonder how many machines have been made in this way? **S.B.**

Sony C7

The fault we had with a Sony C7 VCR was no slow motion. As with all repairs, I ran through the various functions first to see whether there were any other problems – this can provide clues that speed up the repair. Whilst doing this I noticed that in the still mode the noise bar remained where it was instead of moving to the bottom of the picture. All this led me to the SJ-1 (servo control during variable playback mode) panel, where I checked first for the presence of the PG pulse – it's used as a reference in the pulsed motor drive system. The pulse was present at the input, so I moved on to the following rather curious circuit (see Fig. 2), a monostable multivibrator consisting of a NAND gate and a pnp transistor (Q701) – it acts as a pulse divider. The voltages around the i.c. and the transistor were o.k., but the pulses weren't getting through at any setting of the slow-motion control. After some head scratching I noticed that the voltage at both sides of diode D702 was the same at 11V: the diode was o.k., but C701 was short-circuit. Replacing this restored normal operation. **M.S.**

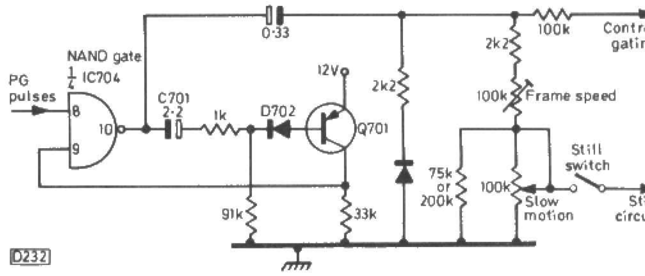


Fig. 2: Divide-by-four monostable multivibrator circuit used on the SJ-1 panel in the Sony C7.

Panasonic NV7000

An interesting – and rather lengthy – problem arose with a Panasonic NV7000 VCR – one with the single systems board (it took me quite a time to get the circuit, and in case anyone else is having trouble it's in a supplementary manual for the NV7000E/B/EO/EN, order number VRD8009-432). The problem was that the machine would unthread after anything from three to seven hours' use, and from then on would not stay threaded up when either play or record was selected. In the pause mode however the machine would remain threaded up. I decided to concentrate on the reel sensor circuit therefore, and after giving it the hairdryer/freezer treatment I came to the conclusion that the reel sensor Hall i.c. was faulty. On looking at the device I found that it was type DN838, whereas the manual specified type DN835. A DN835 was tried but didn't work, so further contact was made with Panasonic. After three months and a lot of phone calls – including some from Panasonic to me – they agreed that there was such a device as the DN838 and finally supplied one. Fitting it cured the fault. **M.S.**

Ferguson 3V22

We've had a batch of Ferguson 3V22 machines recently with an unthreading problem. With the first one the mechanism jammed with the tape fully threaded: a push on the threading wheel cured this, and after a lot of testing the machine was sent out. Then another machine with the same problem came in. After more thorough testing I found that the machine jammed because of the considerable force required to overcome the cam on the timing gear. I then checked the size of the drive belt, and found that it was slightly larger than those we had in stock. Cleaning the pulleys and flywheel cured the trouble, and since then six more 3V22s have come along with the same problem. **M.S.**

Life with a Thorn 2000

Bob Walker

WAY back in 1975 a pal of mine bought four ex-rental colour TV sets fitted with the Thorn 2000 chassis and carried them off to the far north – Caithness to be precise. His idea was good and engagingly simple: retain the best and sell the rest. He did the former and I acquired one of the latter. Unfortunately on the journey north the sawtooth waveforms of the highway combined with his lively manner of driving (one speed: top) led to each set being maladjusted to a certain extent. He attempted to overcome this small problem by perming one from four on each of the seven panels plus the tuner: those of a mathematical turn of mind, particularly aficionados of the football pools, will appreciate that there are 4^8 possible combinations. When he'd done his best (worst?), he had a reasonable picture and sound on the chassis in the best-looking cabinet. He bought a service manual and proceeded to tweak up his choice with the aid of an AVO 8. The discarded panels were bunged into the remaining cabinets to await future attention, which in the usual way of things he never got around to. This is where I came in.

Test Equipment

With the worthy intention of learning something about colour television at first hand, I acquired the second best looking cabinet and, in the absence of any better method, selected the youngest (by serial number) of the remaining panels. One problem that faced me was somewhat inadequate test gear – an antique AVO Minor, an early type of AVO oscillator and a Model 45B Taylor valve tester. What good is a valve tester for this job do I hear you ask? Well, I've used it quite successfully for a number of years for testing capacitors – by shunting them across the cathode and heater of a known good valve and reading the insulation resistance direct from the meter in Megohms. With the 50V potential, the readings obtained are quite successful. To this lot I added a modern 20kΩ/V Supertester so that my voltage readings would be comparable to those quoted in the manual using an AVO 8 which, sadly, I couldn't afford. I also bought a Bi-Pre-Pak crosshatch generator kit and built it up. I was then ready to begin.

Initial Inspection

The first task was to inspect each panel and the tuner for obvious faults. Believe it or not, I found 39 dry, broken or bad connections on the various panels. Having dealt with these I noticed that some of the knife edges in the system switching had been eroded by use – mainly the supply points.

Single-standard Conversion

I took out all three system switches therefore together with their solenoids, also the a.g.c. microswitch on the tuner, taking care to connect pins 12 and 13 of connector EC9 on the i.f. panel. A TV engineer friend thought this a brave undertaking. Perhaps he meant crazy. Bridging all the 625 system switch contacts was a laborious job, but one I considered worth the effort – after all I'd converted what had been described in the servicing articles on the chassis in the March-June 1973 issues of *Television* as "probably the most complex domestic device ever sold" into a simpler, more efficient single-standard set.

Having gone this far I decided to remove various surplus 405-line components for use as spares. This led to an unforeseen snag on the convergence panel – removal of R31 broke the printed circuit earth line and the outer casing tags had to be linked to restore continuity. The items I removed on this panel were the presets R16/19/29/31/32 plus resistors R17/18/25/30. It's worth noting that the blue parabola coils L3/5 are of the same type and interchangeable, as are the dynamic blue lateral correction coils L6/7. L5 and L7 were left in place therefore.

No attempt was made to convert the tuner to single-standard operation for fear of upsetting its alignment, though I'd successfully converted the dual-standard tuner used in the Pye 368 monochrome chassis on a previous occasion.

Degaussing was arranged to operate on the BBC-2 button only.

Convergence

Having completed the groundwork as it were I switched on and selected BBC-2, which usually provides the best picture in this area, then followed the setting-up and convergence procedures set out in the manual. It was obvious that several of the convergence potentiometers were in poor condition, due to charring and distortion of the insulating cases, and these were replaced. A really heavy-duty wirewound control was used to replace the horizontal R/G amplitude potentiometer R26 which had been very badly affected. It was then possible to set up the convergence satisfactorily, producing quite a good picture.

Faults Encountered

All that was some six years ago. Having removed many possible and actual sources of trouble at the initial stages, I've since been rewarded by long periods of reliable operation. Perhaps because of this, some of the faults I've subsequently encountered have been a bit obscure.

The first breakdown produced a sudden drop in vision and sound levels, hinting at the collapse of the aerial system since the gales in the Caithness region often, like the driving of my aforementioned pal, approach 100 m.p.h. This hypothesis didn't apply however since I was using an indoor aerial. The trouble was traced to the common r.f. amplifier transistor VT1 in the tuner – it's type BF180. For reasons of urgency, I abandoned the principle of not interfering with the tuner's innards, and having taken excessive pains to ensure precise physical duplication of the transistor's connections (using a pair of dividers and careful sketches) I fitted a replacement that appeared to be physically identical. To my great surprise, this gave better results than before. Experience with the tuner unit has been otherwise uneventful.

The next fault was intermittent. Both sides of the picture would at odd intervals serrate inwards momentarily – to an almost hour-glass shape. A timebase or sync fault? No, the

trouble was on the power supply panel, where the 73V bridge rectifier's reservoir capacitor C6 (2,000μF) had a loose tag. While on the subject of the power supply panel, difficulty in setting up the beam limiter was resolved by replacing the control (R8) which had developed a faulty track. The fusible resistors R16//17/18 incidentally are in the system switch return circuits and can be removed.

I don't wish to tempt providence, but must report that the regulator panel has given me no trouble – C4 (100μF) was found to be a bit leaky and was replaced, that's all. The i.f., decoder, e.h.t. and line timebase panels have also been relatively trouble free. On the line timebase board one of the tags on C33 (800pF, across the lower line output transistor) broke due to fatigue, and one of the connections to the line oscillator coil L2/3 came adrift.

I've had one interesting and elusive fault: the symptom was of fragmented blue streaks superimposed across an otherwise acceptable picture. Clearly (even to me) this called for close scrutiny of the video panel, particularly the blue colour-difference channel. Following some unsuccessful attempts to solve the problem by incisive theorising, I had to fall back on my customary last resort – checking individual components. As time wore on and despair came nearer and nearer, I began exchanging components one at a time between the red and blue channels in the hope that the blue streaks would turn red. After swapping over the transistors, diodes and larger capacitors without effect, I suddenly realised that the only capacitor left in the blue channel was the B – Y preamplifier transistor's emitter capacitor C30 (750pF) – the transistor is VT17. The problem was resolved when I popped in a new 750pF capacitor. It would have saved much time had I realised that the slight blackening on the faulty capacitor was due to its failure rather than heat from the transistor itself. We live and don't learn. I was assuaged by the fact that the cost of the replacement was only 0·5p!

The discovery of the faulty beam limiter preset control mentioned earlier arose from a search for the cause of inability to extinguish the three beams on set-white using the three first anode potentiometers on the convergence panel. The culprit turned out to be R34 (1·2MΩ), which is in series with the red first anode control, on the earthy side. It had gone high in value. While attending to this I noticed that one of the end clips on R1 on this panel had split. Although there was no apparent effect at the time, the vertical shift would have eventually been affected since the resistor is in series with the field shift control.

Last but not least I should perhaps mention the occasion when the set caught fire. Someone had used an ordinary nut and bolt instead of plastic on the fixing bracket for the transformer on the e.h.t. board. Sparking between the e.h.t. plug PLG12 and the fixing bolt ignited the plastic part of the bracket. It won't happen again!

Conclusion

This last mentioned incident shouldn't deter anyone from acquiring one of these sets ex-rental and following my example. The only regret I have is that I didn't acquire two of them in order to have a standby set which could also be used to localise faults more rapidly. My Thorn (or BRC as they then called themselves) 2000 still has the original tube which must be getting on for 15 years old yet still gives an acceptable picture. This tends to support my engineer pal's view that 90° tubes last a lot longer than wider angled types. Who cares if they take up more space? I don't. Such is my faith in the old set that I'm now contemplating the addition of remote control – more about that another time. ■

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 157 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

ITT CVC30 CHASSIS

The original fault was no sound or raster, the power supply tripping. Removing the scan coil plug removed the overload, and we found that the line output transistor, the e.h.t. tripler and the line output transformer were all short-circuit. These were replaced, restoring the picture and sound, but after three-four minutes the output transformer started to arc and the set tripped. This time the line output transistor was all right but the tripler and transformer had again failed. As a check a transformer only was fitted. This restored the sound but arcing again started after a couple of minutes.

Excessive voltages are being developed across the line output transformer. Under normal circumstances this can happen only if the h.t. voltage is excessive or the flyback tuning is incorrect. R808 sets the h.t. voltage – check for 160V across C52. Then check the flyback tuning capacitor C1102 (0·0082μF) by substitution, using an ITT approved type. Make sure that it's properly connected across the line output transistor T1101.

RANK Z179 CHASSIS

Line tearing was the first thing we noticed, then the display became a mass of sinusoidal waves – with some colour present. The circuit breaker then operated. This was reset, but the next time we tried the 5A mains fuse blew. The mains rectifier thyristor was found to be short-circuit, but on replacing this the same sequence of events occurred. Disconnecting the tripler makes no difference.

It seems to us that the line frequency is so far out that the line timebase is drawing excessive current. We suggest therefore that you concentrate on the area of the TBA920 sync/line oscillator chip. Applying an externally derived 11V supply across 4C16 will enable you to check the line drive waveform appearing at pin 1 of the chip (4SIC1). A new chip could well cure the fault, and it would be worthwhile checking the associated capacitors – 4C16 (220μF), 4C7 (4·7μF) and 4C2 (0·01μF), also the 12V zener diode 4D3.

RANK A823B CHASSIS

Every six-eight weeks the ETT6106 i.c. in the touch tuning unit has to be replaced. The symptoms are the same each time: the station goes off tune and no other channel can be selected. Are there any precautions that should be taken?

As it's a MOS i.c., it should be kept in the conductive foam or foil supplied right up to the moment it's used. Before handling it, ensure that you and any instruments are fully discharged, i.e. earth everything. In the set itself, check that the c.r.t.'s Rimband is properly connected to its isolating/discharge network 4C3/4R12, and that the degaussing shield is connected *via the c.r.t. base panel* to chassis – this is very important. Finally check that the h.t. voltage at fuse 8F3 does not exceed 210V.

KUBA FLORENCE

The trouble with this set is pincushion distortion, mainly at the top and bottom – the top is particularly bad. I've tried adjusting the controls on the panel at the side of the line output transformer, but can't get any improvement.

The fault is almost certainly caused by shorted turns in one of the three transductors mounted in the centre of the panel you mention. If the distortion is similar at the top and bottom, the cause is the transductor on the left – the one with the circular magnet. If the fault is mainly at the top, the centre transductor is faulty. When the latter transductor has to be replaced, the loop of resistance wire for thermal compensation should be noted.

GEC 3133

The initial fault was no sound or raster. R233 (33Ω) in the feed to the line driver stage was found to be burnt out, and after replacing this sound and vision have been restored. When the set is first switched on however all I get is a bright line across the centre of the screen. Wavy lines appear after about a minute, as though the line and field are unlocked, and after another couple of minutes a locked picture appears. This remains for the rest of the evening – the sound is good from switch-on.

It seems that the SN76544N/07 sync, line and field oscillator chip (IC251) is slow in getting going. On mains operation, its start-up voltage comes via D403 from the junction of C404/5 and R403/4. It would be as well to check the two electrolytics C404 (680μF) and C405 (150μF). If all's well here, check the 12V zener diode D207 which regulates the supply to the chip, then suspect the chip itself.

KÖRTING HYBRID COLOUR CHASSIS

There's a persistent hum bar accompanied by a wavy edged raster. The line timebase valves have been changed and all the electrolytics in the power supply have been replaced. There don't appear to be any problems with dry-joints or faulty earthing connections.

There could well be two faults. Hum on the line is usually due to C417 (25μF) which decouples the h.t. supply to the line oscillator stage being open-circuit – it's mounted on the line timebase panel. A leaky AD142 24V regulator transistor (T651) is often the cause of a hum bar, though the associated 12V zener diode (D651) or the two other transistors in the circuit (T653 and T652) can also be responsible.

TYNE 5224

The initial fault was no results, though the tube's heaters were alight. I found R310 open-circuit and replaced it with a 10Ω, 1W resistor. This restored the sound and picture, but there's sound-on-vision with the volume control turned up fully and striations are present over about the first third of the raster.

R310 should be 1Ω, and rated at 7-10W – it's the surge limiter in the feed from the mains isolating transformer to the l.t. bridge rectifier. Assuming that there are no tuner or

alignment problems, the sound-on-vision effect could be due to loss of capacitance in the l.t. bridge rectifier's reservoir capacitor C301 (2,200μF). The striations at the left-hand side are probably due to failure of the line linearity coil's damping resistor R401 (1·5kΩ, 5W) – it's strapped across the coil (L401) on the convergence board.

DECCA GYPSY MS1210

Initially there was a half inch black border on the left-hand side. Eventually the width decreased to about two inches and R89 (10Ω) started to smoke. Whilst making some tests the height was also lost, leaving a bright spot at the centre of the screen.

At least you've got e.h.t.! R89 is the 120V supply rectifier's surge limiting resistor, and the fact that it's smoking suggests that the rectifier itself is leaky (D15 ITT2002) or that its reservoir or decoupling capacitor is suffering from the same fault (C101 8μF and C42 0·1μF respectively). Once this fault has been cleared check that the scan yoke plug is properly connected and that the line scan coupling capacitor C96 (2·2μF 250V polyester) is o.k.

THORN 3500 CHASSIS

The initial trouble with this set was low brightness. There didn't seem to be anything seriously wrong, so we went through the complete setting up procedure given in the manual. As a result, the brightness was brought up to an acceptable level, though the colours seem to be flaring or streaking, especially reds and whites. Is it the tube?

Although the streaking is occurring in the RGB output stages, it's usually caused by them having to drive hard because the tube is low emission. Try the effect of increasing the c.r.t.'s grid bias and advancing the first anode presets while reducing the setting of the preset brightness control. If this fails to improve matters, try reactivating the tube.

KB VC51/2 CHASSIS

There's a pale but clear picture on this set, with good sound. If the brightness control setting is increased, the picture size increases.

First the pale picture. If the EF183 and EF184 i.f. valves and the PCL84 video output valve are in good condition, it's likely that R82 (4·7MΩ) between the slider of the contrast control and the system switch has gone high in value. The picture ballooning is probably due to the PL36 line output valve or the DY86/7 e.h.t. rectifier valve being low emission – if necessary check R147 (2·5Ω) in the e.h.t. rectifier's heater circuit (it's in the valveholder).

THORN 1590 CHASSIS

There's no picture for the first one-ten minutes after switching on, just a raster with flyback lines. The sound is o.k., and a faint picture can just be seen in a dark room. Switching on and off will often produce the picture, which will continue for hours.

The symptoms suggest that the raster is being synchronised during the fault, leaving little other than the video output stage and its supply as the source of the trouble. Check for some 95V across the HT4 supply reservoir capacitor C111 when the fault is present. No voltage or a low reading suggests that C111 and/or rectifier diode W14 is faulty. Otherwise the video output transistor VT9 is the main suspect, with the video driver transistor VT6 a less likely possibility.

ITT CVC30 CHASSIS

There's a horizontal bar of non-linear field scan about half an inch deep and one and a half inches from the top. It's persistent but not always present, coming and going at random. There is also vertical non-linearity: to the left of the screen the scan speeds and then slows whilst to the right it slows then speeds.

We've known this sort of field scan instability to be due to D10 in the field output stage being defective or to the 0·0047μF h.f. stability capacitor across the collector-base junction of the lower field output transistor going open-circuit. If necessary, check the current sensing feedback resistor R39 (1·5Ω), the field scan coupling capacitor C22 (2,200μF), and the field timebase module. The line non-linearity could be due to a defective scan-correction capacitor – check C68 (0·91μF).

DECCA SERIES 10 CHASSIS

A good-quality rebuilt tube was fitted to this set, and after obtaining good purity I attempted to set up the grey scale. This was impossible, due to green colouration on the right of the raster and blue colouration on the left. The convergence is very good, and all the drive and first anode voltages etc. are correct.

We suggest you replace the three first anode decoupling capacitors/spark gaps (C273/4/5) on the c.r.t. base. If the fault persists, check the RGB clamp diodes D205/D210/D217 on the decoder panel.

RANK T20 CHASSIS

After two-three hours the screen will suddenly become brilliant white, with no picture information. The condition usually lasts for a few seconds only, after which the picture returns to normal.

It seems that the three c.r.t. cathode voltages are collapsing when the fault occurs. Check the 200V line at 3C52 and the 12V line at 3Z6/1 during the fault. If these voltages remain constant, the TCA800 demodulator/matrixing chip may be at fault or the c.r.t. could have an intermittent interelectrode leak.

ELIZABETHAN MODEL T12

The efficiency diode (D404) in this set failed. It's marked 25N/FG2, but I'm having difficulty obtaining a replacement. Any suggestions for alternatives? The line output transistor also seems to be unusual – type 2SC508.

The efficiency diode used in these sets does tend to go open-circuit. We've found that the types of diode used for EW raster correction in colour sets make suitable replacements, e.g. types MR854 or BYX71-350. Our book lists the BD193, BDX22, BUY63, 2N4240 and 2N6233 as equivalents to the 2SC508.

QUERY COUPON

Available until 20th January, 1982. One coupon, plus a £1·00 (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 156.

TELEVISION JAN. 1982

ITT CVC9/1 CHASSIS

The problem is with the remote control action – the channels can be changed and the set switched off, but the sound mute command has no effect. The RG1 transmitter unit has been tested and found to be o.k., so the trouble would appear to be in the remote control receiver unit.

When the mute button is pressed, transistor T1704 in the CMC20 receiver assembly should switch on, i.e. its collector voltage should drop. If this occurs, i.c.s IC1701, IC1702 and transistor T1705 are suspect. If T1704 remains off however, check the capacitors in the tuned mute-detector circuit – C1707 (0·01μF) which tunes the coil, and the coupling capacitor C1708 (0·001μF). Then tune the coil (L1701).

PYE 368 CHASSIS

There's excessive width due to the VDR in the width/e.h.t. stabilising circuit being open-circuit. Unfortunately the type number is not shown on my service sheet.

The VDR is a Mullard type E298ED/A265. There shouldn't be much difficulty in obtaining one of these, but if you want you could try using an ordinary 220kΩ resistor. The set would work with this but the size of the picture would vary a little as the evening wore on.

TEST CASE

229

Each month we provide an interesting case of television servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

As the use of VCRs becomes more widespread we are finding ourselves increasingly encountering problems of non-compatibility between various VCRs and various TV sets. If the VCR works o.k. with another TV set and the TV receiver gives perfectly good off-air pictures, you try to get the Technical Advice department of either manufacturer interested! A typical situation arose recently when we delivered a new JVC VCR to a school for use with a 20in. Philips colour set – one fitted with a late version of the G8 chassis.

The problem arose when the VCR was hooked up to the TV set. When a newly recorded section of programme was played back, the picture was found to be marred by vague horizontal floating bars. The effect was similar to that produced by co-channel interference, but the bars were horizontal and random, tending to flutter up and down the screen. Although the bars were neither sharply defined nor stationary, we estimated that each was about 1-1·5cm across. The effect showed up best on monochrome and on dark scenes. Reception conditions were not good at the location, but there had been no signs of interference on the screen of the TV set whilst the recording was being made. The VHS demonstration tape was next tried, as it's known to be a good recording, but the fluttery bars were still present – though not so noticeable.

A loan set was installed and the whole outfit was brought back to the workshop. It turned out to be one of those cases where every sensible, logical avenue of investigation got us nowhere, ending up in further general puzzlement. The JVC VCR worked well with a Decca and a Thorn TV set – the bars were barely noticeable on these sets, though they were still there. A Bang and Olufsen set gave perfect results. Other VHS machines were tried with the Philips TV set: some gave similar results, others were not quite so bad. None we tried gave interference-free playback on the Philips TV set. Was the VCR responsible for the trouble, or was it the TV set?

Abortive substitutions of the VCR's modulator and r.f. booster modules and the u.h.f. tuner in the TV set wasted much time and produced no improvement at all. It's at times like this that we envy the postman his simple, carefree life – breezing in with out-of-stock notifications and parcels full of the wrong spares, then gliding off through the villages and sunshine in his little red van . . .

We decided to ignore the VCR and concentrate on the TV set, which was fitted with the BA00 combined i.f./chroma panel. To spare you some of the agony we suffered, we can reveal that the source of the trouble lay here. To cure it, a modification rather than a repair was called for. Can you guess what was happening? See next month for an explanation, the cure and another item in the series.

ANSWER TO TEST CASE 228
– page 100 last month –

We left our engineer last month in the smoky living room above Crowfield Post Office, with a Grundig Model 1632GB whose Telepilot remote control system was apparently suffering from loss of gain. The individual concerned is still kicking himself for failing to realise what all you readers must have twigged a month ago! Brought up on ultrasonic remote control systems, our man either didn't realise that the Telepilot 120 is an infra-red system or failed to appreciate the significance of this.

The trouble was caused by the same affliction that had been responsible for the dim picture and the e.h.t. fizz. A layer of tarry gunge covered the light filters on the remote control transmitter and receiver. These dark filters are fitted over the transmitting l.e.d.s and the receiving photodiode to filter out extraneous light: when they were cleaned and degreased, the remote control system was super-sensitive again. What state must that man's lungs be in – and what state would his pocket be in if we'd charged him a realistic sum for all the trouble we'd gone to?

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